

**Establishment and Optimization Methodologies for
“QMOC” (Quality Management Organization Based on CMMI®)**

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Abstract

“QMOC” is a core organization and its establishment & optimization is inevitable for CMMI® application & implementation. However, we have realized that there are no detailed “QMOC” establishment & optimization methodologies. We analyzed 10 actual “QMOC” organization structures (3 departments from Fujitsu head office, 6 from subsidiaries, and 1 from offshore subsidiaries, which make a total 10 departments or subsidiaries which have implemented CMMI®). We have realized that all “QMOC”s consist of four inevitable functions. We have developed establishment & optimization methodologies for “QMOC” based on our analysis results of these four functions.

1. Issues on “QMOC” Establishment & Optimization

Many business units of Fujitsu head office and subsidiaries are implementing QM (quality management) process improvements by CMMI® application & implementation. They have established Center of Excellence for CMMI® named “CMMI® WG” and hold monthly working group meetings for practical QM process improvement knowhow exchange regarding CMMI®. “QMOC” is a core organization and its establishment & optimization is inevitable for CMMI® application & implementation. As a result of our discussion for “QMOC” establishment & optimization methodologies in “CMMI® WG”, we have concluded that the existing concept which explains that “QMOC” consists of EPG(Engineering Process Group) and QAG(Quality Assurance Group)(refer to Figure 1) is insufficient for practical “QMOC” establishment & optimization and we cannot understand logically the existing “QMOC”s organization structures of Fujitsu departments and subsidiaries. As the existing actual “QMOC”s organization structures are completely different from each other, EPGs and QAGs are arranged complicatedly. “QMOC” establishment & optimization issues on our discussion in “CMMI® WG” are as follows.

Figure 1. The Existing Methodology for “QMOC”

“QMOC” = EPG + QAG	
Definitions	
EPG Engineering Process Group	QAG Quality Assurance Group
A group for establishment and optimization of “standard quality management process” based on CMMI®	A group for institutionalization of “standard quality management process” based on CMMI®

Table 1. Appendix : Explanations of Acronyms in This Paper

No.	Acronyms	Explanations
01	QMOC	Quality Management Organization based on CMMI®
02	CIBU	CMMI® Implemented Business Units are actually implementing quality management process improvements by CMMI application & implementation.
03	QMD	Existing Quality Management Departments based on ISO 9000 or other QMSs
04	CMMI® WG	CMMI® Working Group is the center of excellence for CMMI of Fujitsu head office & subsidiaries.
05	QM	Quality Management

1.1 The Most Critical Issue - Absence of “QMOC” Establishment & Optimization Methodologies

There are no detailed “QMOC” establishment methodologies except for the existing concept described above. “CMMI® WG” members have established “QMOC”s through trial and error. Although “QMOC” also needs to be improved continuously, there are no “QMOC” optimization methodologies; hence it is very difficult to optimize “QMOC” intentionally and strategically and to evaluate “QMOC” properly.

1.2 Practical Issue Details

- (1)There are no methodologies for organization structures of EPGs and QAGs.
- (2)No relationship methodology with “QMD” (existing quality management departments) - There is no relationship methodology between “QMD” (cf. “QMD” for ISO9000) and “QMOC”. “CMMI® WG” members cannot evaluate whether their relationships are the best or not.

(3) No relationship methodology between "CIBU" (CMMI[®] implemented business units) and "QMOC" - There are no relationship methodology between "CIBU" (Note: we call business units which are actually implementing QM process improvements by CMMI[®] application & implementation "CIBU" for distinction from QMOC" in this paper) and "QMOC". "CMMI[®] WG" members have established their relationships only through trial and error.

(4) Actual organization type of EPG and QAG - According to the existing concept explained above, EPG and QAG are "Group". However, there is no detailed definition of "Group" for issues such as whether EPG and QAG should be a department or not. A committee or an individual will be acceptable or not. There is no methodology; "CMMI[®] WG" members have decided actual organization type of "QMOC" through trial and error.

Although "QMOC" establishment & optimization would have a serious impact upon the success of CMMI[®] application & implementation, but there are no existing methodologies. The objective of this paper is to propose "QMOC" establishment & optimization methodologies which can solve the most critical issue and the four detailed practical issues mentioned above.

2. Classification Analysis for the Existing "QMOC"

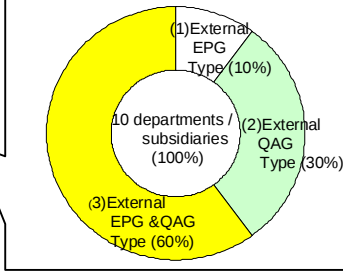
We focused on "QMOC" positions whether they existed outside of "CIBU" or not, we performed classification analysis of actual Fujitsu head office departments and subsidiaries. We could classify existing "QMOC"s under (1) External from "CIBU" EPG type, (2) External QAG type, (3) External EPG and QAG type, and (4) No external EPG and QAG type in this classification analysis. However, we could not find type (4) in our analysis. Targets of our analysis were 3 departments from Fujitsu head office, 6 from subsidiaries, and 1 offshore subsidiary, which made a total of 10 departments or subsidiaries which implemented CMMI[®]. Results are as follows.

Note01: Actual "QMOC"s have original department names in Japanese, but they are referred to as EPG or QAG in this paper, based on the objectives of the then "CMMI[®] WG" members who have established the "QMOC".

Note02: EPG, QAG in our classification analysis do not strictly follow the definition mentioned in Figure 1 because of actual existing organization. Normalization of "QMOC" will be discussed in section 3.

Table 2. Classification Results

No.	Types	Explanations	Classification Results	%
(1)	External EPG Type	Only EPGs exist outside of "CIBU"	1 subsidiary	10%
(2)	External QAG Type	Only QAGs exist outside of "CIBU"	3 subsidiaries	30%
(3)	External EPG & QAG Type	EPGs & QAGs exist outside of "CIBU"	3 Fujitsu head office departments 2 subsidiaries 1 offshore subsidiary	60%
(4)	No external EPG & QAG Type	No EPGs & QAGs exist outside of "CIBU"	None	0%
Total			10 departments / subsidiaries	100%



(1) External EPG type (1 subsidiary) - Only EPGs exist outside of "CIBU"

(2) External QAG type (3 subsidiaries) - Only QAGs exist outside of "CIBU". There are some modified types due to internal EPGs and QAGs structures.

(3) External EPG & QAG type (3 Fujitsu head office departments and 2 subsidiaries, 1 offshore subsidiary, which make a total of 6 departments or subsidiaries) - EPG and QAG exist outside of "CIBU". There are some modified types due to external EPGs and QAGs structures and internal EPGs and QAGs structures.

2.1 External EPG Type

2.1.1 A Case of Fujitsu Subsidiary A

"QMOC" of Fujitsu subsidiary A is "External EPG type" (refer to Figure 2). EPG are placed on "QMD" which directly reports to president. EPG exists outside of division A01 and division A02 which are "CIBU". QAGs exist inside of each division. Objectives of this organization structure are as follows.

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- (1) EPG would be commonly used by division A01 and division A02 which are “CIBU”.
- (2) QAGs existed inside of “CIBU” for quick and effective institutionalization of tailored standard QM process based on CMMI® for each “CIBU”.
- (3) “QMD” for ISO9000 had been originally placed outside of “CIBU”. New EPG were placed in the same department with “QMD” because new EPG also would like to be placed outside of “CIBU”. There were 2 organizations in the same department, but “QMD” did not correspond to EPG or QAG correctly.

A CMMI® appraisal team suggested the following improvement points for this “QMOC” when an appraisal was performed.

- PPQA for the PPQA process itself is not done objectively.
- Consistency between standard QM process and tailored QM process for CIBU should be improved.

2.2 External QAG Type

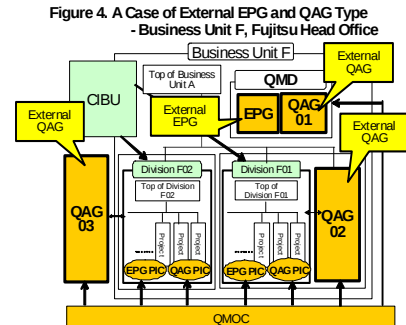
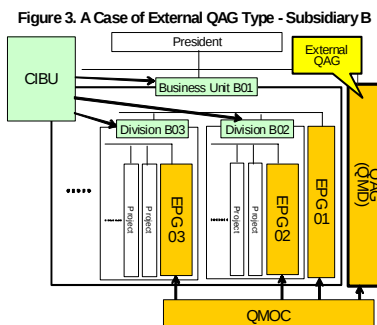
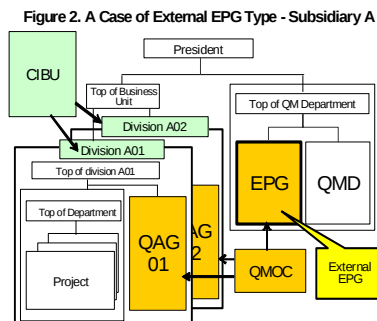
2.2.1 A Case of Fujitsu Subsidiary B

“QMOC” of subsidiary B is “External QAG type” (refer to Figure 3). QAG which directly reports to president exists outside of “CIBU”. EPG01 exists inside of business unit B01. EPG02, EPG03 etc. exist inside of each division (division B02, division B03 etc. which exist inside of business unit B01). Objectives of this structure are as follows.

- (1) There was “QMD” as “quality assurance department” which directly reported to president before CMMI® application and implementation. After CMMI® application & implementation, this department was arranged as “external QAG”.
- (2) There were many divisions in business unit B01. EPG01 was arranged as “internal EPG” which would develop standard QM process based on CMMI® for whole business unit B01.
- (3) There were many divisions in business unit B01, standard QM process for whole business unit B01 should be tailored for each division; hence EPG02, EPG03 etc. were arranged inside of each division.

A CMMI® appraisal team suggested the following improvement point for this “QMOC” when an appraisal was performed.

- Consistency between standard QM process and tailored QM process for CIBU should be improved.



2.2.2 A Case of Fujitsu Subsidiary C

Fujitsu subsidiary C is also (organization chart is omitted) “External QAG type”. Its organization structure is almost the same as subsidiary B, but EPG01 is not a department, instead “EPG committee” which consists of representatives from EPG02, EPG03 etc.

2.3 External EPG & QAG Type

2.3.1 A Case of Business Unit F, Fujitsu Head Office

Business unit F, Fujitsu head office is “External EPG & QAG type” (refer to Figure 4). EPG and QAG01 exist outside division F01 and division F02 which were “CIBU”. EPG PIC (Person-in-charge) and

QAG PIC (not a department but a person) exist inside of division F01 and division F02. Objectives of this structure are as follows.

- (1) "QMD" which directly reported to top of business unit F was arranged as external EPG & QAG department and existed outside of "CIBU". When CMMI[®] was applied, EPG's job or responsibility was the development of standard QM process for the whole business unit F, QAG01 job was its institutionalization.
- (2) EPG PIC and QAG PIC existed inside of division F01 and division F02. EPG PIC's job was the tailoring of standard QM process, QAG PIC's job was its institutionalization.
- (3) QAG02 which supported division F01 and QAG03 which supported division F02 were arranged for the improvement of 3rd party verification. QAG02 and QAG03 were added as "QMOC" improvements a few years later from CMMI[®] application. External organizations (e.g. Fujitsu subsidiaries) were arranged as QAG02 which was specifically in charge of 3rd party verification for Division F01. Some part of QAG03 were also external organizations (e.g. Fujitsu subsidiaries).

A CMMI[®] appraisal team suggested the following improvement points for this "QMOC" when an appraisal was performed.

- QAG supported only the final stage of each project. QAG should support the whole project process.
- Utilization of the process asset library for CIBU should be improved.

2.3.2 A Case of Fujitsu Offshore Subsidiary D

Fujitsu offshore subsidiary D (organization chart is omitted) is also "External EPG and QAG type". EPG and QAG are placed on "QMD" which directly reports to president. EPG PIC exists inside of each project. According to their quality director who established "QMOC", each project manager is an acting QAG PIC.

2.3.3 A Case of Fujitsu Subsidiary E

Fujitsu subsidiary E (organization chart is omitted) is also "External EPG and QAG type". EPG and QAG are placed on "QMD" which directly reports to president. There are many divisions in each business unit. EPG and QAG also exist inside of each division.

3. Functions Analysis for "QMOC" Normalization

"QMOC" classification analysis details are explained in the previous section. Details of 6 major cases are also explained. Summary of classification analysis results is as follows.

- (1) Classification - We focused on "QMOC" positions whether they existed outside of "CIBU" or not, we could classify existing "QMOC"s under four types (we found only 3 types in our analysis), there were many modified types, actual organizations types were multifarious and there was no same organization in our analysis
- (2) Actual organization types - Actual organization types of EPG and QAG are not only a department, but also a committee, PIC, an acting PM, an external organization etc. There are so many actual organization types.
- (3) Relationships with "QMD" - There are some relationship types, e.g. no relationships with "QMD", "QMD" is arranged as new "QMOC" etc.

We realized that "QMOC" organization structures were completely different from each other because "QMOC" were a combination of the following four kinds of EPG and QAG.

- (1) External EPG, (2) External QAG, (3) Internal EPG, and (4) Internal QAG.

However, we realized that not all "QMOC" cases had four kinds of EPG and QAG organizations. Why some "QMOC" cases don't need all four kinds of EPG and QAG, though four kinds of EPG and QAG have their own reasons for existence and their own peculiar functions? We made following assumption to solve this issue.

3.1 Our Assumption

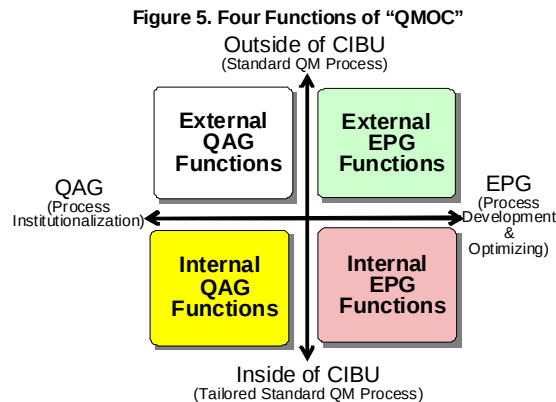
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We assumed that the reason for this issue was four kinds of EPG and QAG were analyzed as organizations. There are so many limitations of organizations, such as budget, number of employees, skill of staff etc. which have serious effects on organizations, then not all “QMOC” cases seemed to have four kinds of EPG and QAG. If four kinds of EPG and QAG are re-analyzed as functions, we would find four functions in all cases. For verification of our assumption, firstly we analyzed their original own pure functions and created Four Functions of “QMOC” matrix (refer to Figure 5).

3.2 Four Functions of “QMOC” Matrix

- (1) Pure functions of EPGs which exist outside of “CIBU” - Their original own pure functions are the development and optimizing of standard QM process based on CMMI[®]. Because external EPG are placed outside of “CIBU”, they can develop and optimize “standard QM process” which is common for all “CIBU”s. We define these functions as “External EPG functions”.
- (2) Pure functions of QAGs which exist outside of “CIBU” - Their original own pure functions are institutionalization of standard QM process based on CMMI[®], and 3rd party verification functions for progress of its institutionalization. They have objectivity because they exist outside of “CIBU”. We define these functions as “External QAG functions”.
- (3) Pure functions of EPGs which exist inside of “CIBU” - Their original own pure functions are tailoring and optimization of standard QM process based on CMMI[®] for “CIBU”. Because they exist inside of “CIBU”, they have their organization’s business knowhow; hence they can perform these functions. We define these functions as “Internal EPG functions”.
- (4) Pure functions of QAGs which exist inside of “CIBU” - Their original own pure functions are institutionalization of tailored standard QM process based on CMMI[®] for “CIBU”. Because they exist inside of “CIBU”, they have their organization’s business knowhow; hence they can perform these functions. We define these functions as “Internal QAG functions”.



3.3 Procedures of Four Functions of “QMOC” Analysis

We analyzed actual “QMOC” organization charts which were explained in previous sections. Our analysis procedures were as follows. (1) Actual “QMOC” organization charts were to be reviewed from view of their original own pure functions by those who had established “QMOC”s. (2) They assigned four functions of “QMOC” to actual “QMOC” organization charts. An objective of this analysis was to show four functions clearly in actual “QMOC” organization charts. Four functions were not clear in actual organization charts because of many limitations of organizations such as budget, number of employees, skills of staff etc. which had serious effects on organizations.

3.4 External EPG Type: A Case of Fujitsu Subsidiary A

Figure 6 shows four functions analysis results. There is “External EPG functions” in EPG which exists outside of “CIBU”, there are 3 functions, “External QAG functions”, “Internal EPG functions”, and “Internal QAG functions” in QAGs which exist inside of each “CIBU”. According to Figure 2, it seemed that there was no “Internal EPG functions” and no “External QAG functions”, actually there were all four functions. There were some issues in “External QAG functions”, because “External QAG functions” existed inside of “CIBU”.

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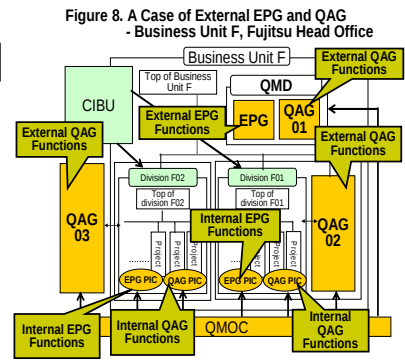
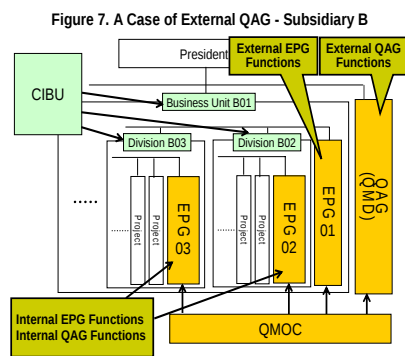
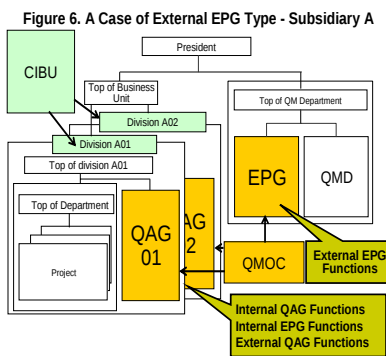
After the hearing with “CMMI® WG” members, we realized that this limitation was addressed by biweekly “QAGs meeting” which was held between each QAG, and fortnightly “QAGs and EPG meeting” which was held between each QAG and EPG. We also realized that there was an unsolved issue which was objectivity of 3rd party verification function of “External QAG functions” because they existed inside of “CIBU”; hence we realized that “External QAG functions” improvement was the most serious issue for their “QMOC” optimization.

We also realized that “External QAG functions” and “Internal EPG functions” should be optimized for improvement points which a CMMI[®] appraisal team suggested. “External QAG functions” should exist outside of “CIBU”. And “Internal EPG functions” should exist as a PIC (Person In Charge) or as a department.

3.5 External QAG Type: A Case of Fujitsu Subsidiary B

Figure 7 shows four functions analysis results. There is "External EPG functions" in EPG01, there are "Internal EPG functions" and "Internal QAG functions in EPG01, EPG02 etc. which exist inside of "division B02, division B03 etc. According to Figure 3, there seemed to be no "External EPG functions" and no "Internal QAG functions", however there were all four functions. We also realized that "External QAG functions" existed in "QMD". After hearing with "CMMI® WG" members, we realized that there were some issues in institutionalization of tailored standard QM process for division B02, division B03 etc. Because no organizations for QAG existed inside of "CIBU". Actually EPG01's help was inevitable for performing these functions by EPG02, EPG03 etc. "Internal QAG functions" improvement is an on-going "QMOC" optimization issue now.

We also realized that “External EPG functions” should be optimized for the improvement point which a CMMI® appraisal team suggested. “External EPG functions” should exist outside of Business Unit B01.



3.6 External EPG and QAG Type: A Case of Business Unit F, Fujitsu Head Office

Figure 8 shows four functions analysis results. "External QAG functions" and "External EPG functions" are assigned to "QMD" which directly reports to business unit F. "External QAG functions" are assigned to QAG02 and QAG03. "Internal EPG functions" are assigned to EPG PIC which exists inside of division F01 and division F02. "Internal QAG functions" is assigned to QAG PIC which exist inside of division F01 and division F02. We realize that there are all four functions of "QMOC". Organizational change for this "QMD" were made, this "QMD" were changed to "QMOC". QAG02 and QAG03 were added, when "QMOC" modifications were made. These QAGs are specific QAGs for 3rd party verification. For high objectivity of 3rd party verification, some parts of them are requested to external organizations such as Fujitsu subsidiaries etc. QAG02 and QAG03 are arranged as two separate departments, not as one department. The reasons of this organization structure are due to following business characteristics of business unit F.

- (1) They provide mission critical services, essential to avoid troubles. Then high objectivity of 3rd party verification functions is required.
- (2) There are 2 divisions in this business unit, business characteristics of these 2 divisions are very different from each other; hence their own specific knowhow is required separately for performing 3rd party verification.

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We also realized that “Internal QAG functions” and “Internal EPG functions” should be optimized for the improvement points which a CMMI® appraisal team suggested. Each function should exist as a department not as a PIC (Person In Charge).

3.7 Summary of Four Functions Analysis

We have explained details of four function analysis in the previous section. We conclude the following based on this analysis.

- (1) We have confirmed that there were four functions in all “QMOC” by our analysis. These four functions are inevitable functions for “QMOC”. We conclude that our assumption is verified.
- (2) We realize that four functions are inevitable for “QMOC”; however they don't always exist as departments. There are so many actual organization types; hence “QMOC” organization structures are completely different from each other.

4.”QMOC” Establishment & Optimization Methodologies

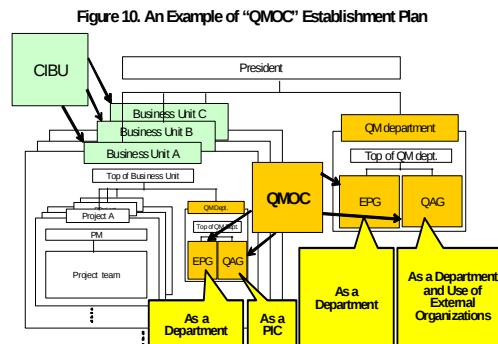
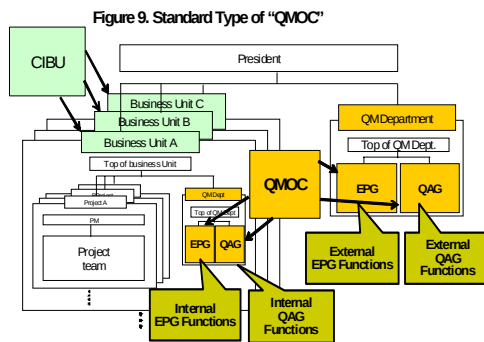
”QMOC” establishment & optimization methodologies based on our analysis results are as follows.

4.1 Standard Type of “QMOC”

According to the summary mentioned above, we assume that Figure 9 shows standard type of “QMOC” organization structure. It is impossible to make different departments performing each of these functions due to limitations such as budget, number of employees, skill of staff etc. Sometimes one function has to be divided and assigned to multiple departments due to business characteristic of “CIBU” (cf. “External QAG functions” in a case of business unit F, Fujitsu head office); hence actual organizations exist not as standard type, but exist as modified standard type.

4.2 Basic Concept of “QMOC” Establishment

By keeping the standard type as a starting point, and considering limitations such as functions assignment to “QMD”, budget, number of employees, skill of staff, business characteristic of “CIBU”, objectives of CMMI® application etc., the organization type for each four functions of “QMOC” is to be decided. Four functions are inevitable, regardless of actual organization types. It is necessary that all four functions should be placed on actual organizations. Organization names can be decided freely. As a rule, “External EPG functions” and “External QAG functions” should be placed on outside of “CIBU”, “Internal EPG functions” and “Internal QAG functions” should be placed on inside of “CIBU”, if these rules are not obeyed, some countermeasures need to be considered.



4.3”QMOC” Establishment Methodology

- (1) Decide which functions should be assigned to “QMD”

Functions of “QMD” should be evaluated. Suitable functions of ”QMOC” which are to be assigned to “QMD” are to be decided based on evaluation results and agreement with “QMD”.

- (2) Establishment of new organizations for functions which cannot be assigned to “QMD”

New organizations have to be established for each function which cannot assign to “QMD”. All new organizations need not be established as a department. Suitable actual organization type should be

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decided for each function based on analysis of limitations such as budget, number of employees, skill of staff, business characteristics of "CIBU"s, objectives of CMMI® application. There are many actual organization types such as department, committee, PIC, acting PM, use of external organizations etc. The size (number of staff etc.) of each function is affected by the objective of CMMI® application; hence is to be decided based on the same. Figure 10 shows an example of "QMOC" establishment plan based on standard type.

4.4 Basic Concept of "QMOC" Optimization

Progress of CMMI® implementation (e.g. outcomes and issues) should be monitored, "QMOC" optimization will be required periodically. "QMOC" optimization should be discussed by each four functions such as change of number of employees for each function, change of actual organization types etc.

4.5 "QMOC" Optimization Methodology

- (1) "QMOC" should be evaluated based on progress of "QMOC" activities, outcome, and issues.
E.g. Institutionalization progress of tailored standard QM process is low.
- (2) Improvement plans by each four functions of "QMOC" should be made based on "QMOC" evaluation.
E.g. For improvement of "Internal QAG functions", "Internal QAG functions" which is currently arranged as QAG PIC should be arranged as a department from next year.
- (3) The limitations such as budget, number of employees, skill of staff etc have to be discussed.
Improvement plans by each four functions are to be integrated as "QMOC optimization plan".
- (4) "QMOC optimization plan" should be implemented.

5. Next Steps

"Absence of "QMOC" establishment & optimization methodologies" which was discussed by "CMMI® WG" is solved to a certain extent by our methodologies. Evaluation results of our methodologies by "CMMI® WG" members who have established and optimized actual "QMOC" through trial and error are as follows.

- (1) Understandings of "QMOC" optimization process have been improved by this "QMOC" optimization methodology; hence we can optimize "QMOC" intentionally and strategically now, not through trial and error, and can evaluate "QMOC" properly.
- (2) Departments or subsidiaries which will start to apply CMMI® also can establish "QMOC" intentionally and strategically and can evaluate "QMOC" organization structure properly now by our "QMOC" establishment methodology.

Next steps of these methodologies are as follows

- (1) There are many departments and subsidiaries which have already applied and implemented CMMI® in Fujitsu group. We would like to analyze these "QMOC"s and verify and modify our methodologies based on additional analysis results.
- (2) Our methodologies are not numerical methodologies (e.g. estimation methodology of suitable number of staff of "QMOC" etc.) now. We would like to analyze these "QMOC"s numerically and modify our methodologies to numerical ones based on additional numerical analysis results.

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