

# Information Demand Pattern for Teams: Structure and Content

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**Abstract.** Organizations experience today an increasing amount of information, which leads to a perceived information overload. This information overload is the cause for more and more wrong decisions and has therefore economic consequences. Especially decision-makers and knowledge intensive workers are affected. They often work in teams with several persons who have to share information relevant for their tasks. Information demand patterns have been suggested as a possibility to reduce the information overload in organizations. Such patterns offer the possibility to reuse knowledge about information demands of a role. This work is guided by the question how the concept of information demand pattern for individual roles can be applied to a team. The contributions of this work are (1) a description of the structure of information demand patterns for teams; (2) a presentation of the correlation between information demand pattern for individuals and teams and (3) a team pattern definition.

**Keywords:** Information Logistics, Information Demand, Information Demand Pattern, Team Pattern

## 1 Introduction

Every day a lot of information is produced. The volume of information has greatly increased in recent years. Society has changed into an information society, where the availability of information cannot be seen anymore as an obstacle for demand-oriented information supply, but retrieving the information by the person in need is the bigger challenge. This development also is valid in organizations, so that they are faced with an ever-growing amount of information as studies have shown [1]. Information overload has demonstrated a high topicality as indicated by recent studies [2].

In contrast to previous assumptions, when information was considered a rare good, that more information corresponds to improved problem solving and decision-making, today the opposite effects can be observed: too much information leads to delayed decision-making, the feeling of information overload and sometimes even wrong decisions [20]. Thus, the amount of information is a growing challenge in today's information society [3]. Locating relevant information turns out to be difficult and consequently the need grows for adequate structuring and individualized access [4].

Information logistics as an application field of business information systems deals with this problem and has the goal to achieve an improvement of the information flow in organizations by providing a demand-oriented information supply. Information logistics offers methods, concepts and tools to achieve an improvement. The concept of demand-

oriented information supply denotes that the right information at the right time, in the right quality, in the right form and at the right place is provided to the right person [5].

In order to improve the information flow inside companies information demand patterns (IDPs) were developed [6]. IDP address the information demands of a single role represented by a person within an organization, i.e., IDP identify information repeatedly required for this role. Similar to patterns in other disciplines of computer science, these patterns have the purpose to detect a proven solution to a problem in order to reuse it in other application scenarios. With information demand patterns, the identified organizational knowledge is captured in a structured and reusable way that enables to support the targeted role and counteract a flood of information. Overall, the efficiency of information provision should be improved, thus work processes can be effectively designed and carried out. Furthermore the time required for finding the relevant information can be reduced. For the same role in different application contexts it should be possible, to provide the needed information on time, in quality and in the accuracy required as proposed by the definition of information logistics[6].

In the corporate environment, work often is characterized by teamwork in projects involving several participating roles. As IDP address only single organizational roles, they have shortcomings when it comes to the support of teams. Not addressed by IDP are, e.g., coordination of information provision within teams or information shared by different team members. An extension of IDP towards teams addressing the information demands of a whole team is expected to help improving structures and processes within the team and to generally increase the efficiency in the team, as it is developed on an aggregate level and has a holistic perspective on the team.

Thus, the leading research question for work presented in this paper is, whether the concept of information demand pattern for individual roles can be extended and made applicable for a whole team. In this context, the paper discusses the content of an information demand pattern for teams and the inner structure of such team patterns. The contributions of this work are (1) a description of the structure of information demand pattern for teams; (2) a presentation of the correlation between information demand pattern for individual roles and teams and (3) a team pattern definition derived from this.

The work is structured as follows: section 2 describes the background for this work. Section 3 illustrates our methodical approach used to answer the research question whether the concept of information demand pattern for roles can be adapted for teams. Section 4 describes the procedure to develop the structure for information demand pattern for teams (team pattern). Section 5 discusses the findings resulting from this procedure. Conclusions and an outlook are given in the last section 6.

## **2 Background**

This section introduces background knowledge for the work with a focus on the areas of “information demand” and “information demand pattern” for individual roles.

### **2.1 Information Demand**

The understanding and definition of the term „information demand“ used in this paper is based on an investigation performed from 2005-2007[7]. The main objective of this

investigation was to identify the connection between information use and different work-related aspects, such as work processes, resources, and organisational structures, in order to achieve a better understanding of the term information demand. The investigation comprised 27 interviews with individuals from three different organisations, a sample which represented all levels of the investigated organisations, i.e. from top-level management via middle management down to production- and administrative personnel. Among the results of the investigation was a definition of information demand as well as a conceptualisation of this term. Information demand will be used throughout this paper with the following meaning: “Information demand is the constantly changing need for relevant, current, accurate, reliable, and integrated information to support (business) activities, whenever and where ever it is needed.”[7]

Information demand has a strong relation to the context in which such a demand exists. The organisational role having the demand and for what task the information is demanded as well as the setting in which such tasks are performed are important aspects for understanding information demand. Thus, the concept of information demand context has been defined both conceptually and as the core of the method with respect to modelling, evaluating and analysing of information demand: “An Information Demand Context is the formalised representation of information about the setting in which information demands exist and comprises the organisational role of the party having the demand, work tasks related, and any resources and informal information exchange channels available, to that role.”[8]

Based on the above results, a method for analysing information demands and capturing information demand context has been developed as part of the research project infoFLOW-2 during 2010 – 2012 [8]. This method is documented in a method handbook, which describes the work procedures to be performed, the notation for documenting information demand contexts, and the concepts and aspects to be taken into account during analysis.

## 2.2 Information Demand Pattern

After detecting the information demands of a role in a company, Sandkuhl presented the concept of information demand pattern. As with patterns in other disciplines of computer science, these patterns have the purpose to detect a proven solution to a problem in order to reuse it in other application scenarios. With information demand patterns, the identified organizational knowledge is collected in a structured and reusable way. The term information demand pattern is defined as follows according to [6]:

*An information demand pattern addresses a recurring information flow problem that arises for specific roles and work situations in an enterprise, and presents a conceptual solution to it.*

Information demand pattern consist of five integral components: *Name of the pattern, Organizational context, Problems, Conceptual solution and Effects.*

The **name** is used to identify the pattern. This is usually the name of the role, which the pattern describes. The **organizational context** explains the application context in which the pattern can be used. This can be departments, functions or domains. **Problems** represent the difficulties and challenges that the person is facing in filling their role in the company. Also duties and responsibilities of the role are subsumed under this point.

How the described problems of the role can be solved is shown in **conceptual solution**? It is divided into three areas, *information demand*, *quality criteria* and *timeline*. Information demand describes the information that is necessary to fulfil the duties and responsibilities of the role. The quality criteria describe the quality in which the information must be available such as the general importance of the accuracy, the time and the completeness of the information. The timeline represents the time at which the required information must be available at the latest.

The **effects** part describes effects that may occur if the information is not available or not in time. The possible effects occurring may be associated with the following dimensions: economic effects, time and efficiency, quality of work, motivation, learning and experience and customer [6].

The concept of information demand pattern has been studied in several other works and its applicability has been validated [9-11].

### 3 Methodical Approach

This section describes the methodical approach that was used to develop the structure of an information demand pattern for a team. Figure 1 illustrates this methodical approach, which also was used to answer the research question, whether the concept of the information demand patterns for individual roles can be transferred to a team.

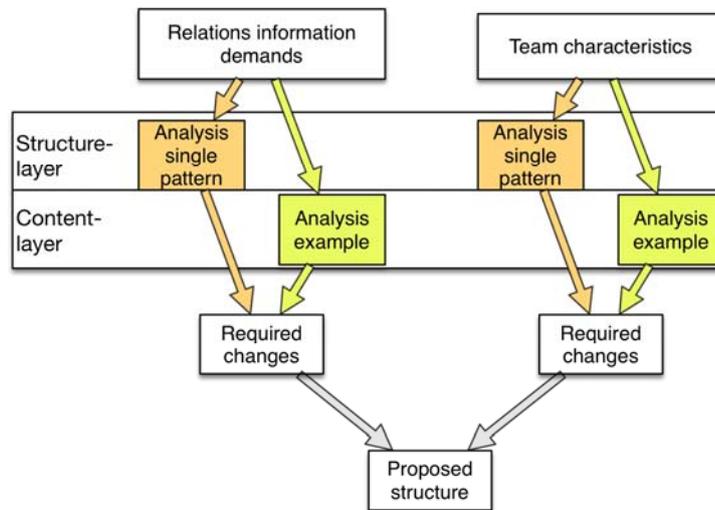


Figure 1: Methodical approach

The information demand of an individual role in a team and its connection to the information demands of other roles in the team are the starting point of our investigation. It is examined whether the information demand of a team is more than the sum of the information demands of all roles in the team. More concrete, it is examined how the information demand as a central element of an information demand pattern is related to

other pattern elements on structure and content level. This approach is performed in two independent tracks:

First, the relations of information demands between the different roles involved in a team are investigated. Second, the information demands concerning the team itself, which can be derived from the properties of a team, are investigated. In both tracks two analysis are done: one on the structural level of the pattern and one on the level of pattern content using an example.

Starting point for the analysis of information demands in terms of the characteristics of teams is a detailed examination of the properties that are defined in the literature concerning a team (see section 4.2). One or more potential information demands are derived from the definition of the term "team" for each described property of a team.

The identified information demands of a team are then validated against a given information demand pattern for a team. This way it is compared if the information demand identified from literature can also be found in an existing pattern.

After the content-based analysis and the structure-oriented analysis of the characteristics of a team, concrete modification requirements on the structure of an information demand pattern for a team are formulated. An analysis of the relations of the information demands of the roles involved in a team as well as an analysis of the characteristics of a team are performed in parallel. Analogue to the first track, an analysis is performed at structural level and at content-oriented level.

It is explored structurally in an analysis, where relationships between elements of the individual patterns can be found. This means which elements of an information demand pattern for single roles may have potential connections to other elements of other information demand patterns, if both patterns are part of a team pattern. The analysis at the content-level is performed using an existing team pattern in order to identify links between the information demands of the included individual single pattern.

Change requirements are derived from the two analyses conducted in this track analogue to the first track. The identified change requirements from the perspective of "relations" and from the perspective of "properties" are incorporated in an overall proposal for the structure of a team pattern.

## **4 Development of the structure of a team pattern**

This section is structured in accordance to the methodical approach described in section 3. First, the relations between information demands are investigated and then team characteristics are identified.

### **4.1 Relations**

This section outlines the steps in the analysis of relations between individual patterns. This analysis is performed on structural level, i.e. without an example in mind. The individual components of one information demand pattern are discussed one by one, and the possible connections to a second information demand pattern are discussed.

The *name* of an information demand pattern is typically identical to the role described in the pattern. Therefore, this part of a pattern is not suitable to have a connection to other information demands of other information demand patterns.

The *context* of an information demand pattern describes the application scenario of the pattern. Here is described how and where the pattern may be applied. It may therefore be assumed that links to other information demand patterns are possible. For example, partly overlapping contexts could be expected here. It should be remembered that the context has a direct impact on the responsibilities and functions of a role, and thus has a direct impact on the need to carry out the tasks of information demands of a role. Connections to other dependent departments or dependent functions can be expected to be part of the context as well.

The section *problems* describes in a pattern the problems, responsibilities and tasks that have to be fulfilled by a role. Here it is also conceivable that relations with other patterns may exist. Regarding the responsibilities, relationships between the roles may be present if they have overlapping or partially congruent responsibilities. It is also conceivable for a process-oriented view that downstream or upstream activities can lead to connections between roles.

The component *conceptual solution* of a pattern includes the sub-items of information demands, quality criteria and a timeline. The information demands of a role are derived directly from the responsibilities and tasks. Thus, we anticipate here further connections. It is conceivable that a role may fulfil the information demand of another role. A relationship regarding the quality criteria and the timeline is only indirectly possible, because they depend directly on information demands. Different roles can have the same information demand, which can be fulfilled by the same source of information. It may be, however, that the quality criteria or the time of delivery of the information demands are different.

The part *effects* of an information demand pattern describes the implications that occur, if the information arrive late or do not. Here, it is possible that the structure of the existing single pattern has to be extended in the dimensions of the effects, to take into account effects on the team itself.

After the consideration of relations at a structural level between information demand patterns, the subsequent part describes the analysis of an existing information demand pattern of a team and the relations between the included single patterns. The example selected for the comparison is the team pattern<sup>1</sup> for a research group at universities which has been developed and published as part of [21]. Analogue to the previous structural analysis, the components of the role patterns, which are part of an existing team pattern, are compared hereinafter in order to identify similarities, commonalities and dependencies.

The *name* of the individual pattern is not well suited to identify a connection between two single patterns. The *context* of an information demand pattern briefly describes the usage of the pattern. It becomes clear in all IDP that the roles are part of the team (i.e., in the example pattern, the research group at a university). Furthermore, in this case the contexts of the individual patterns and the team pattern focus on organizing and conducting a university course.

The component “*problems*” clearly describes the connection between the individual patterns as well. For example, direct references to other roles exist in the team pattern. The analysis of the tasks and responsibilities confirms this. Here are direct dependencies visible within the team. A professor, for example, may need software to prepare a

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<sup>1</sup> The structure of this team pattern is identical to the structure of an IDP. Part of our research work is to investigate if and how this structure has to be adapted.

course. Responsible for this task is the role “system engineer”. Another example is the personnel planning of courses. For this, the professor needs the information on the availability of the staff, who can carry out the courses. This information is provided in accordance with the scientific staff of the research group.

The component “*conceptual solution*” and its sub-items information demands, quality criteria and timeline were also compared. There are information demands in the example, which must be supplied by a different role within the team. For example, the professor has the information demand „availability of tools for teaching“. This information demand is provided by the role „system engineer“.

Furthermore, there are similar information demands. This may be the case if the task is similar or even identical. For example, the roles „research assistant“ and „professor“ have the information demand „interiors of rooms“ to prepare lectures. On the other hand, there are similar information demands, which require the identical information to satisfy the demand, but differ in the task related to the information demand. This can be seen in different quality criteria or a different time line of the information demands. An example of this is the information demand „course description“, which can be satisfied by the same information object. The „professor“ and the „research assistant“ both have this information demand to prepare their courses. However, the quality criteria and the time line differ partly.

The component *effects* characterizes the impact in defined areas such as „economic impact“, „impact on the quality“ or „impact on the customer“. This shows that identical information demands may differ in the states of the dimensions of the effects concerning the included single patterns. Striking here is that both distinguish the effects of the information demands of the single pattern when another objective is to be satisfied with the information, and if an identical task has to be fulfilled by a different role.

The structural analysis showed that there are relations between different single patterns. These areas are: the context, the problems including responsibilities and tasks of a role, the conceptual solution and the effects. For the structure of an information demand pattern for a team can be concluded from these findings, that several structural changes must be implemented in the current structure of team patterns. The content analysis from an existing team pattern of a research group at a university confirmed the results of the structural analysis.

## 4.2 Information demand team characteristics

In literature, various definitions for the terms „group“ and „team“ are presented. Some of these definitions use the terms equivalently. Regarding the concept of a group it can be assumed that a variety of definitions can be traced back to the definition of Nerdinger and Rosenstiel. Therefore, our further work is based on that definition. A group is defined by [12] by six properties:

A group is a *majority of people*, existing for a longer period of *time*, having *direct contact* with each other, fulfilling different *roles*, *sharing norms and values* and have a team spirit [12]. The definition of the term „team“ is highly controversial in the literature. Widespread, however, is the opinion that a team is more than a group. A team has as an additional feature „a common task“ that is perceived by the team in the context of an organization. Therefore, it can be said that a team is always a group, a group but not necessarily a team [13, 14].

The focus of this work is on the development of an information demand pattern for a team within an organization. Therefore, we define further a team as a group that has a task to fulfil within an organization.

Based on the seven defining properties of a team, we will identify information demands of a team. These seven properties are examined and discussed according to their potential impact on the structure of a team pattern. A team is a „majority of people“. This property is the precondition that group dynamics can run and group phenomena can be observed. A team pattern must represent the included single pattern.

A team exists for a „longer period“. As already mentioned, a team is going through a so-called team-building process with several steps. At the end of the process an increased performance of the team is assumed [12]. The members of a team are in „direct contact“. Because of this direct contact, it seems that information demands regarding the coordination to fulfil either common tasks or for a team communication exist. Inside a team a „role differentiation“ occurs. The differentiation of roles in this definition is based in psychology and it appears that at present there is no impact on the structure of a team pattern.

A team develops „common values and norms“. A team seeks to improve its performance. Therefore, in the sense of self-organization a team develops in time internal processes or procedures. This characteristic can lead to information demands within a team and must be considered in the structure of the information demand pattern for a team. A team develops a „we-feeling“. This characteristic of a team is also psychological in nature and appears to have no direct impact on the structure of a team pattern itself.

A team has within an organization „a responsibility“. This property has a direct impact on several components of an information demand pattern. From the mission of the team, the organizational context is derived for the team pattern. Furthermore, the task of the team provides sufficient material for the item „problems“ with the sub-items responsibilities and tasks within a pattern. Derived from the context and the roles and responsibilities may be information demands that are necessary for performing the tasks of a team, but may not be identified in the individual patterns of the involved roles. This is an additional information demand of a team.

The context is about the application of the pattern. The involved IDP have to be mentioned here. In the “problems” part of patterns, there are relations between the involved single patterns. For example, it becomes clear that the role „tutor“ has close contact with the role „research assistant“. This can be explained by the fact that the tutor overtakes tasks for the research assistant.

The part of the conceptual solution, with its sub-items of information demand, quality criteria and time line shows a plurality of contact points between the individual patterns. Regarding the information demands it is clear that some information demands are provided by members of the team

## **5 Results**

This section describes how the known structure of an information demand pattern for individual roles has to be extended to meet the identified requirements of a team pattern. This section discusses the elements of a role pattern element by element and includes at

the appropriate places change requirements and the resulting expansion of the structure for the team pattern.

The *name* of the information demand pattern for a team should clearly describe the team. This makes it easier to identify the pattern in a repository. Currently, pattern names are used as the primary key for distinguishing patterns. It is proposed with regard to a clear distinction between the patterns to introduce an ID for team patterns to simplify the identification. This may also be useful with respect to further developments. This ID can be added as first field in the pattern structure.

The *organizational context* describes the purpose of the team pattern. This description has to be extended by a description of the team itself and by a description of the individual roles inside the team. It makes sense to assign IDs for roles as well.

The pattern element *problems* of the team describes problems, responsibilities and duties of a team. This element has to be extended by the „common task“ of the team. In addition to do interviews in order to develop the team pattern, it often is possible to obtain this information from organizational documents. This element should be extended by „relations and dependencies“ relevant to describe the organizational task of the team.

The section *conceptual solution* contains the identified information demands, the quality criteria and a timeline.

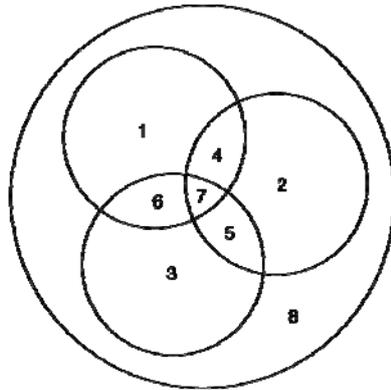
The information demands on the one hand include demands that are necessary for performing the tasks and responsibilities of each single role and other demands which are necessary for the team itself. It should be possible to identify whether the information demand is needed by a single role or by the entire team. It makes sense to use the proposed „organizational context“ ID here. It should be also clear whether the information meeting the demands is generated by roles involved in the team pattern or externally. To facilitate the identification of information demands, they should be provided with an ID. This would make it possible to map the already mentioned concept of views on information demands of information objects.

The *quality criteria* describe the quality of the previously identified information demands. The criteria general importance, accuracy, temporal meaning and completeness are considered. There are two adjustments necessary indicated by previous research. First, it makes sense not to allow the interviewed people to rate the general importance, but to derive it by calculation from the other criteria included in this pattern element [15, 16]. Second, it has been shown in several interviews that the respondents have difficulties understanding that the possible values of the criteria of the pattern element „quality criteria“ differ from the possible values of the „effects“. The set of possible values for both pattern elements should therefore be unified.

The *time line* is only slightly affected in terms of changes for a team pattern. It seems useful to define chronological fixed points to which the supply of the information can be related. The definition of the fixed points should be done across teams. For further use of team patterns by computer systems the information on the temporal availability of the information demands should not be offered only graphically, but in addition in tabular form

The *effects* described in individual patterns currently indicate the severity of impact in the dimensions of „economical“, „time“, „efficiency“, „quality“, „motivation“, „learning and experience“ and „customer“. These dimensions should be extended by the item „team“.

In the analyses described in section 4.1, we were able to identify relations between information demands of participating roles. Below these relationships are briefly explained. To ease the graphical representation, Figure 2 includes only three roles.



*Figure 2: Relations between information demands in teams*

The individual information demands of the roles included in a team are depicted in Figure 2 with circles (1, 2, 3). It is possible that the demands overlap between the roles, but each role usually also has its individual information demand. This demand is shared by no other role because it is determined by the tasks and responsibilities of the role.

The intersections (4, 5, 6) between the information demands two roles show that roles may have a partially identical information demand. This may be the case if two or more roles have to perform a similar task in the team.

Furthermore, there might be an information demand, which is identical for all roles that are included in an information demand patterns for teams (7). An example of this can be the room number of a regular team meetings.

As already described, a team in an organization has an information demand, which goes beyond the sum of the information demands of the individual roles (8). These information demands may be derived from the task and responsibility of the team itself.

## **6 Conclusions**

Information demand pattern for individual roles have been known for years and validated in several international projects. They allow to capture the information demands of a role within a company and to make the knowledge about this demand reusable. Within contemporary working environments, work in teams is becoming increasingly important. Thus, even for teams the knowledge about typical information demands of teams can support team work as such and organizational efficiency. This was the primary motivation to investigate whether the concept of information demand patterns can be applied to an entire team within an organization.

The starting point for this work was therefore the question of how on the one hand the structure of an information demand pattern for a role must be extended to fit the demands of a team and what relationships exist between the information demands. On the one hand we took into consideration the relationship between information demands

and the characteristics of a team. Both aspects were discussed on a structural and on a content-oriented level. From this analysis we extracted change requirements for the structure of a team pattern. On the other hand and in addition to the structure of a team pattern, relations between individual and group patterns have also been discussed.

Main limitation of our work so far is, that it stays on a conceptual level, i.e. there was no empirical test other than applying the new team pattern structure on paper. Future work will have to include team pattern development using the new structure and evaluating its feasibility.

Further research activities should also address the issue of granularity of information demands when capturing them by using the information demand analysis. It has been found that differences in the granularity of information demands in individual patterns play a significant role in the development of team patterns from existing individual patterns. It therefore seems sensible to consider these findings already in the collection of information demands with an information demand analysis.

Future research should also address views on information demands within an information demand pattern. Let us assume that two roles have the same information demands according to their IDP, but different quality criteria, effects and time horizon. If these two IDP are integrated into a team pattern, should the team pattern translate these same information demands into two different information demands with different quality criteria or into one information demand with two different views, one for each role?

It also planned to use the existing team patterns as input for a technical solution for implementing information supply, e.g. by extending previous work in e-mail communication [17-19].

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