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An Organisational Interoperability Agility Model

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Abstract

Recently, there have been significant changes in the nature, scale, scope and diversity of military operations. There is an increased tempo of operations as Defence Forces are now often involved in multi-agency and concurrent operations ranging from relatively benign national or regional support activities through to high intensity coalition war fighting activities. Unilateral operations are rare; joint, combined and coalition operations are now the rule. Coalitions are often formed on an *ad hoc* basis and ostensibly at short notice. They are often fluid, with partners joining and leaving or scaling their commitments during the course of the collaboration or operation.

There are many implications for military organisations flowing from these trends and this requires the development or modification of modelling and measuring techniques to assess the impact on military roles. This paper focuses on the development of an Organisational Interoperability Agility Model that aims to capture the dynamic aspects of working in coalitions including the ability of an organisation to contribute to the rapid formation and reformation of coalitions, including novel ones. It builds on the Organisational Interoperability Model developed by Clark and Jones (1999), and draws on the organisational literature, the agility literature, and the authors' experiences within Defence.

1. Introduction

Recently, there have been significant changes in the nature, scale, scope and diversity of military operations. There is an increased tempo of operations as Defence Forces are now often involved in multi-agency and concurrent operations ranging from relatively benign national or regional support activities through to high intensity coalition war fighting activities. Unilateral operations are rare; joint, combined and coalition operations are now the rule. Coalitions are often formed on an *ad hoc* basis and ostensibly at short notice. They are often fluid, with partners joining and leaving or scaling their commitments during the course of the collaboration or operation.

These trends are illustrated in recent operations in which Australia has participated. For example, in September 1999 for the first time Australia led the planning, coordination and conduct of a major multinational activity, namely International Force East Timor (INTERFET), under the auspices of the United Nations. The force involved an array of nations with diverse cultures, languages and national capabilities. The multinational force drew from major Western allies, the European Union (EU), Northern Asian countries and regional South-East Asian and Pacific Island partners. In 2000, operations in East Timor were transitioned to the United Nations Transitional Administration in East Timor (UNTAET), with a reduced Australian role and presence.

In 2003, the Australian Defence Force (ADF) participated in a regional assistance mission to the Solomon Islands (RAMSI) government to restore law and order. The mission was led by an Australian official of the Department of Foreign Affairs and Trade with military personnel from Australia, Fiji, New Zealand, Papua New Guinea and Tonga providing security for police assisting the Solomon Islands Government. Here the military were not in the lead but were in a security support role - maintaining a clearly visible physical presence. The Australian contribution also included Australian Federal Police, Australian Protective Services and Australian government civilian officials. In 2005, the ADF continues to provide a level of security for police as well as logistic and operational support.

Coalitions such as these tend to be fluid, with the participants, their roles, level of commitment, and the command and control arrangements changing over time. This results in a level of complexity significantly greater than traditional combined or multinational military operations. In addition, the commitment by nations can extend beyond the bounds of the actual operational period.

These trends mean that defence forces are seeking forces that are more agile, rather than forces optimised for specific conditions. This includes forces that are capable of operating in a range of contexts, with smaller footprints, using a wider range of options, and that are more resilient. Concurrently, there is a need to develop or modify modelling and measuring techniques to assess the impact of this on military support and future war fighting roles.

Clark & Jones (1999) developed an Organisational Interoperability Model (OIM) that broadly assesses the non-technical or human-activity aspects of one organisation's ability to interoperate with another. These factors had been widely recognised as being important contributors to the ability of organisations to work together effectively. Fewell *et al* (2004) reviewed the OIM (2003 version) in light of the changes outlined above and the emphasis towards a networked centric approach. The outcome was a more generalised model more applicable to current and emerging changes in military operations.

However, it was recognised that OIM (2004) does not capture the contribution made to OI by any single organisation (the level achieved may be due entirely to the efforts of one partner). Neither does the OIM capture the temporal aspects of interoperability e.g. the ability of an organisation to change and adapt to both individual partners and group dynamics during an operation or an organisation's ability to structure and prepare to interoperate with a group of other agencies before the operation and coalition are known.

This paper focuses on the development of an Organisational Interoperability Agility Model (OIAM). It builds on previous versions of the OIM and draws on the organisational literature, the agility literature, and the authors' experiences within the Defence domain.

What is Organisational Interoperability Agility?

Organisational Interoperability Agility (OIA) is about a single organisation's *potential* to have agile interfaces to other organisations in future coalition operations. It assesses an organisation's ability to adapt to changing circumstances i.e. adjust to constant changes in the environment, the activities required to be performed and changes within and between coalition partners and the composition of the group. It is the agility of an organisation's non-technical interfaces and concerns an organisation's ability to maintain and adjust its organisational interfaces under adverse and unexpected conditions. It is about whether an organisation can reach the levels of organisational interoperability necessary, or desirable, to interoperate within a group of organisations in a manner that is both timely and sustainable for the duration of the operation. An organisation with a high OIA should be able to contribute to the rapid formation and reformation of coalitions, including ones involving novel partners and service providers, without adversely affecting its ability to participate in future coalitions.

This does not mean that an organisation with a high OIA is necessarily agile on its own. It means that, on joining a coalition, the organisation should be able to contribute to coalition agility.

Outline

Section 2 provides background material on the two main models used in the development of the OIAM. Section 3 discusses the proposed philosophy with regards to assessing OIA, which is necessary in order to apply the OIAM and Section 4 describes the methodology used to develop it. Section 5 summarises the results of the research behind the OIAM and Section 6 outlines the initial model. Section 7 discusses the strengths and limitations of the work so far, and Section 8 discusses the future directions and a way ahead with the inclusion of organisational baselining in support of the OIAM.

2. Models of Agility

A theoretical basis for assessing agility, as it pertains to organisational interoperability, is still in its infancy. This is particularly so when one considers the military literature, where the concept of agility is still being refined. However, in other fields agility has been more widely studied. One source of inspiration is the world of commerce. Here, an agile enterprise has been described as one which can “...easily adapt to tomorrow’s unpredictable changes” (Wong & Whitman, 1999) and as “the ability to adapt proficiently (thrive) in an environment of unpredictable change” (Dove and Hartman, 1996). The organisation must be able to do this within a useful timeframe. Thus, organisational agility is a mechanism for constantly evolving an organisation in order to survive dynamic changes within the environment in which it operates. Agility is not a product that can be purchased but a capability of a harmonised but complex socio-technical system. It is the result of modifying and tuning numerous subsystems within the organisational sphere of influence. This may mean changing the products or delivery mechanisms, which an organisation uses, in response to changes in the external environment. However, it could also mean changing the organisation in response to equipment failure or other internal failures. The authors consider that agility must cover both ‘breadth’ or the number of things that can be done as well as ‘depth’ or the number of ways of doing similar things.

Dove (2004) says that organisations go through three steps towards increasing agility. First, they respond to requirements for agility – that is they are reactive rather than proactive. They deal with events as they occur, rather than planning for them. Second, they start planning for change, although they often do not have the required information, and finally they start collecting information about likely changes to the organisational and external environment to support the planning and decision making process. Each step enables improvements in the processes used the previous steps. Dove and Harman (1996) talk about agility in terms of change management, and give a more detailed agility maturity model for organisations, ranking change management as ‘accidental’, ‘repeatable’ where rules are developed, ‘defined’ where metrics are applied, ‘managed’ where organisational entities are held accountable, and ‘mastered’ where the rules are replaced by principles. The properties they associate with agile organisations are associated with the ability to justify and obtain buy-in for change, relationship management, innovation, knowledge management and the use of metrics.

Dove has also looked at agile systems and identified the following as desirable properties: self-contained units, plug-and-play style compatibility, flexible capacity, unit redundancy, facilitated reuse, non-hierarchical interaction, distributed information and control, deferred commitment, self-organising relationships, and evolving standards (Dove, 2000). The military is adopting the plug-and-play concept in order to increase agility – as in the US Navy’s new aircraft carriers (Cross II, 1999).

Agility in the military world has received less attention. Alberts and Hayes (2003) report on a method for describing agility using six dimensions. These are robustness, flexibility, resilience,

innovation, responsiveness and adaptation. It is suggested that high levels in many of these dimensions may be required simultaneously to enable high levels of agility. They also note that “Agile organisations do not just happen.” They are the result of constant organisational reflection, understanding, change and adjustment to an organisation’s structure, command and control approach, concepts of operation, command and support systems, and personnel to achieve a synergistic mix of the right organisational characteristics. Alberts and Hayes (2003) breakdown of agility has received considerable attention within the US military – for example Beres and Cochrane (2003) and Smith (2004) both used it in their analyses of agility. In addition, it tries to incorporate many alternative perspectives and is therefore broader than some other breakdowns that have been proposed (eg Lloyd, 2004).

Smith (2004) and Harland et al (2004) note that agility is about the ability to create and utilize options. Therefore, the methodology used to develop the OIAM considered the six characteristics of Alberts and Hayes (2003), supplemented by a consideration of the depth, breadth, and number of options.

In summary, an agile organisation is aware that change is required, has or is able to develop a number of good quality options or alternatives to cope with the change, is able to choose an appropriate option or set of options and implement or transition to them in a timely and seamless way.

3. Assessing Organisational Interoperability Agility

Uncertainty in the nature of future warfare, and the increasingly dynamic nature of coalitions mean that it is no longer sufficient solely to conduct a static assessment of the Organisational Interoperability of an organisation, such as post-hoc assessments between pairs of organisations using the OIM. A method of assessing an organisation’s ability to operate within the context of an uncertain and dynamic coalition environment, including future environments, is required.

A pragmatic approach to assessing OIA is required. It is not feasible to consider every possible future interaction, operation, or even every potential coalition partner (some of whom may not exist at this time) and conduct a comprehensive OIM assessment – even without allowing for the dynamic nature of future coalitions (and that future partners or service requirements may not exist yet).

Thus, the method of using the OIAM envisaged by the authors relies on identification of the agility space (the scope of considerations such as the types and number of organisations likely to be involved and the set of activities to be performed), generalities, and recent historical evidence.

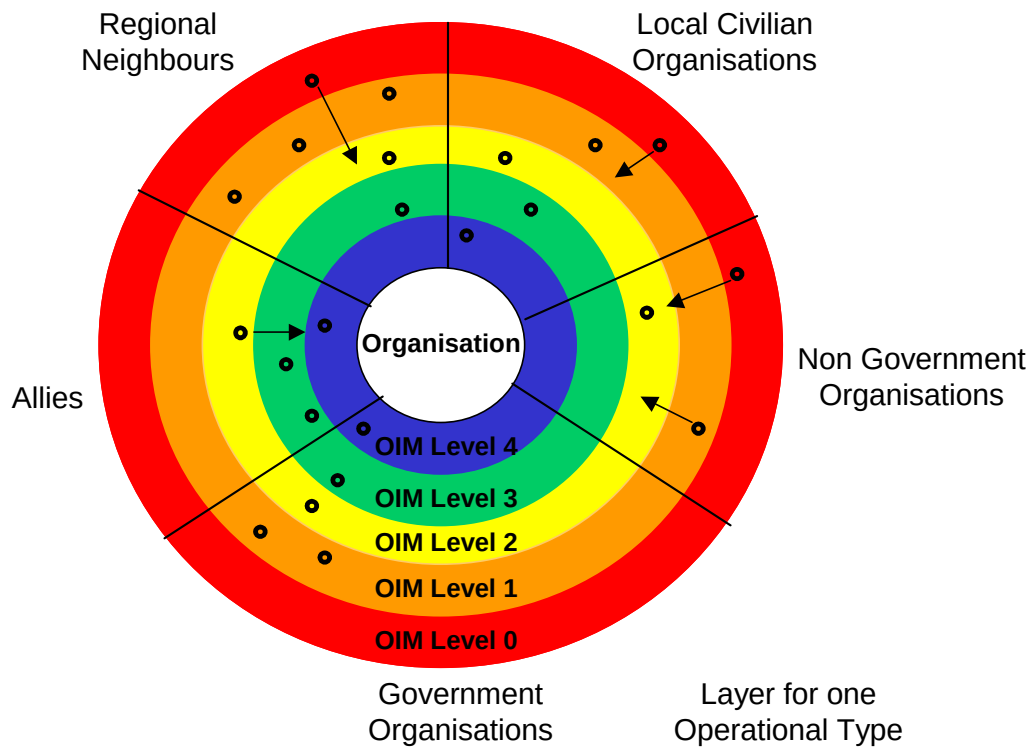


Figure 1 The Levels of OI for a particular organisation with other organisational types for one set of operational types and activities. Arrows indicate either a desired or actual change in OI.

When dealing with an uncertain future, analysts will hold different views on the necessity of considering interactions. An organisation that might find itself operating alongside or in support of such diverse agencies as the Burnside City Council (South Australia), New York Fire Department, Amnesty International, Greenpeace, NASA, and the hypothetical Australian Space Agency will have to be considerably agile. Greater agility will be required if the organisations involved, the activities conducted, or the operating environment changed frequently, or if interactions need to be sustained over a substantial period. Articulating the agility space considered provides more robustness and repeatability in the work, allowing other analysts to expand or contract the original assumptions as required.

Three key areas of scope have been identified by the authors: the *organisations* that may need to be interfaced to; the set of *activities* involved in the interactions between the organisations (including their duration); and the *environment* in which the activities are to be conducted and in which the organisations are to interface.

Generalities at a higher level of abstraction¹ are required to manage the analysis. It is suggested that organisations, activities, and environmental factors are grouped by common purpose, culture and nature of potential interactions. For example, organisational and cultural groups may include allies, other military organisations, NGO's, other government departments, local civilian organisations and religious or economic groups in the countries in the scope of the analysis.

¹ In more recent operations it has been acknowledged that barriers to interoperability at lower levels of abstraction have been culture, lack of a well articulated and understood common purpose and a lack of understanding about others' capabilities and modus operandi. This was the result of communication between Gina Kingston and Leoni Warne, DSTO.

Analysis of recent or current operations can then be used to identify the current levels of OI, and to see how successfully an organisation has coped with adversity and uncertainty in the recent past.

For example, consider Figure 1. It plots organisations in several groups, and shows that at any point in time an organisation will have some organisations with which it has a high OI level (inner rings) and organisations with which it has a lower OI level (outer rings). What an organisation with a high OIA level should have is the ability to quickly and seamlessly move organisations from the outer rings to the inner as required (indicated by the arrows). This could be achieved in several ways, including internal changes or supplementation and training of the external parties. Neither party may necessarily have a leadership role.

4. Methodology

The approach taken in developing the OIAM was based around a review of the literature and the development of a suitable structure for capturing factors relevant to, and assessing the agility of an organisation's ability to interact with other organisations in possibly novel or unplanned coalitions.

In developing the structure, the authors' preference was to remain with the concept of a Maturity Model, such as the Levels of Information Systems Interoperability (C4ISR AWG, 1998) and the OIM already in use within the interoperability community. These models typically assess maturity (in this case of various forms of interoperability) by assigning a level of maturity to each of a number of attributes. The models are usually developed so that success (or maturity) of the overarching concept requires success (or maturity) in each of the attributes, and thus the maturity of the overarching concept is defined as the minimum level of maturity of the attributes. Unlike most maturity models, the OIAM, was not derived from studies of how organisations achieved a mature agility capability.

Since the OIAM is an assessment of both Agility and Organisational Interoperability, the literature in both of these areas was used to identify potential schema for framing the OIAM. In particular, two approaches were examined: the six dimensions of Agility described by Alberts and Hayes (2003) and the four attributes of the Organisational Interoperability model developed by Clark and Jones (1999).

The literature for a variety of relevant fields including agility, interoperability, and organisational learning was scoured and all of the factors resulting from this investigation were considered for incorporation into the model, regardless of whether they were theoretically or empirically validated or not. The inclusion of the factors needs to be reviewed as case studies using the OIAM are undertaken. Furthermore, the depth and breadth of the literature review was necessarily limited by the time available. However, efforts were made to include factors associated with the breadth of interactions as well as their depth. The authors and other researchers may identify and incorporate additional factors into future versions of the OIAM. The factors identified in the initial literature review were then mapped to the two sets of attributes in order to assess the suitability of the Agility and OIM attributes for framing an OIAM.

The methodology used to develop the OIAM framework hinged on the result of questions applied in the preliminary phase and final development phase as follows:

Preliminary phase

In particular, the following questions were asked:

1. Were any additional factors identified in the literature that were not captured by either of the proposed sets of attributes?
2. Were there factors that were highly relevant to more than one attribute in each of the proposed sets of attributes?

This resulted in two early models, each consisting of a set of attributes (Agility or OIM attributes) and contributing factors from the literature and a preliminary assessment of the two potential frameworks for assessment.

Final development phase

The final decision on which model to adopt built on this preliminary phase and looked at how readily the early models could be modified in order to become maturity models. In particular, the following questions were asked:

3. Is it possible to identify a hierarchy of levels of achievement for each attribute from almost non-existent (0) to extremely high (4)?
4. Is it possible to identify an associated hierarchy of factors for each attribute?
5. Is there a dependency between the attributes, such that the level of Organisational Interoperability is dependent on a corresponding level for each attribute?

5. Agility versus OIM Attributes

The following table outlines the results of applying the methodology described in Section 4 to the OIM and Agility attributes. In summary, the literature was more readily mapped to the OIM attributes, it was easier to determine hierarchical levels, and meet the other requirements of a Maturity Model. This is in part because there is a larger theoretical body of literature on which to draw for Organisational Literature. It is anticipated that as the field of Agility, and in particular Military Agility matures, that it may be beneficial to revisit this analysis.

Consequently, the OIM attributes were used as the basis for the OIAM. However, because of the difficulty in assessing the ability to assess agility in developing understanding a priori, this was combined with the preparation attribute in this version of the OIAM. As the model and its application are evaluated, this recommendation will be closely examined.

Although not a factor in selecting the attributes for the new model, this approach also provides some continuity between the OIAM and the OIM and provides sets of sub-attributes that appear to change together.

Methodology Questions	OIM Attributes	Agility Attributes
1. Were there any additional factors identified in the literature that were not captured by either of the proposed sets of attributes?	Most factors identified in the literature were explicitly identified in the OIM factors that relate to the OIM attributes. Other factors mapped well to the OIM attributes.	Mappings were possible between most of the factors identified and the Agility attributes, however the lack of an Agility theory meant that the authors had to rely on their judgment for the mapping.
2. Were there factors that were highly relevant to more than one attribute in	Some factors identified in the literature related to both preparedness and another	Most factors identified in the literature were related to several of the agility

each of the proposed sets of attributes?	attribute. In particular, the ability to assess agility in understanding seemed to be largely related to preparation, and cultural and organisational diversity was related to all of the attributes.	attributes. This is not surprising since it is recognized that the Agility attributes are not independent. Factors related to Flexibility and Adaptability seemed highly correlated, and it was difficult to identify factors related specifically to Innovation.
3. Is it possible to identify a hierarchy of levels of achievement for each attribute from almost non-existent (0) to extremely high (4)?	In principal, a hierarchy based on the nature of changes that an organisation was prepared, willing and capable of enacting was relatively easy to identify. A second possibility, based on the OIM levels was also considered, but not used, in part, to maintain the value of the two approaches.	Levels were difficult to identify as the attributes themselves included differences in the nature of the changes and in the absence of a theory of agility the only method identified was based on the percentage of the agility space covered.
4. Is it possible to identify an associated hierarchy of factors for each attribute?	The above levels readily mapped to the factors.	In the absence of a theory of agility, the above levels were difficult, if not impossible to map to the attributes.
5. Is there a dependency between the attributes, such that the level of Organisational Interoperability Agility is dependent on a corresponding level for each attribute?	In the absence of a theory, the mapping needs to be verified. However, a history of working with the OIM allowed for an initial proposal to be developed and Preparation and Ethos were readily aligned with each other.	In the absence of a theory, and accepted examples of degrees of agility, it was difficult to determine the relationship between attribute levels and the OIA. For example, is it possible to have a high OIA through being very Flexible and Adaptable but not Innovative?

The next section examines the factors that were believed to be important to agility for each of the OIM (and OIAM) attributes, and how these were associated with levels in the maturity model. It should be recognised that some of the factors are relevant to more than one area, and are only discussed in the area to which the authors assigned the factor. For example, cultural experience has two associated factors, 'Willingness to interact with other cultures', which is discussed under 'Ethos' and 'Experience to interact with other cultures'. Willingness to adopt, and experience with, different C2 styles is discussed under 'Command and Coordination'.

6. Model Overview

As previously discussed, OIA is about an organisation's ability to achieve appropriate levels of OI with other organisations, for a set of activities and in a set of particular environments, in a

timely and sustainable manner. This may be because under normal circumstances they maintain a high level of OI with those organisations – including consistent preparations, and the development of consistent understanding, command and coordination arrangements and ethos. However, in practice, this will only be possible with a few organisations and a few well-understood modes of operation. Therefore, an organisation with high OIA will need to have other mechanisms in place to rapidly change their level of OI.

OIA is a balancing act between being able to maintain performance under adverse conditions and being able to adapt to changing conditions. It is about being nimble in a range of contexts including novel and future ones. The progression through various levels of preparation to nimbleness provides a basis for the levels. For example, personnel who develop and nurture many contacts both within and across organisations already have established entry point(s) into other organisations. Others may have more general skills such as the ability to develop and foster contacts quickly, identify well-networked personnel, develop trust swiftly and establish good working relationships.

Preparation

The Preparation attribute of the OIM describes the preparedness of the organisation to interoperate. It measures the degree to which there are harmonised comprehensive and congruent preparations between the organisations being evaluated. This includes the doctrine i.e. the rules and practices that will apply, as well as the degree of previous relevant training and experience. As mentioned previously, Dove and Hartman (1996) say that organisations go through three steps with regard to change management. Paraphrasing, these are roughly ad-hoc responses, planned responses, and informed responses. In terms of changing OI, this can be interpreted as: organisations first try to use or adapt existing doctrine to reduce the impact of an unforeseen event as required, then plan adaptations in case of an event, and finally tailor adaptations based on information about emerging requirements. The attributes captured by these stages are also reflected in the military literature and are captured in the Preparation attribute of the OIAM. For example, agile organisations need to be able to collect information about future requirements.

The need for “flexible” doctrine is often cited as an enabler of coalition operations (Hura *et al.*, 2000) but the factors underpinning this are not described. The authors propose that familiarity with alternative sets of doctrine may provide the foundation for interacting with new organisations from similar organisational groups. However, unless the doctrine covers the entire agility scope, the organisations also need to have mechanisms in place for rapidly developing and implementing doctrine.

Many authors such as Palin (1995) and Clark and Jones (1999) have recognised the importance of education, training and exercising, especially live exercising, in enhancing interoperability. The need for this increases with the complexity of the coalition i.e. the range of organisational and cultural groups participating. It therefore seems reasonable to extend the OIM sub-attribute for the OIAM to cover routine planning of operations, training and exercising with partners from different organisational groupings and in different environments. As this has significant time and cost implications, an alternative strategy is to accept a lower standard OI with many organisations and to have the ability to fast track training and exercising prior to specific operations.

It was also decided to amalgamate the OIM attribute Understanding into Preparation as to some extent, the understanding developed within an organisation of different languages, doctrines and of other organisations belonging to a range of organisational and cultural groups and the ability to share and use knowledge is an aspect of preparation (as well as being related to Ethos). Put another way, the potential to understand other organisations is dependent on the Preparation,

while the actual level of Understanding cannot be determined until during or after the event of interest. Again, the OIM sub-attributes could be extended for the OIAM as above. These include having a shared or common interpretation and understanding of, for example, command instructions, capability, intent and the doctrine being used, with a wide variety of organisational and cultural groups. This would be expected to be facilitated by having a wide variety of relevant collective experience working with such groups including, for example, involvement in multi-organisational structures, peer exchanges, and having mechanisms and resources in place to overcome/mitigate against potential problem areas e.g. due to language differences (Palin, 1995). For example, the utility of liaison officers has been widely acknowledged.

Information sharing practices are also important. This involves more than network infrastructure, and includes having the appropriate understanding, training and processes in place e.g. to expedite the sharing of information including some classified information with other organisational groups.

Command & Co-ordination

The corresponding OIM attribute evaluates how well the participating organisations fit into the command structure and adapt to the leadership style. Thus, it seems reasonable to extend this, as was done previously, to cover different organisational and cultural groups such as those organisations using network centric warfare. Factors include an ability to accommodate differences in command and leadership styles and a willingness to do so. A related issue is the flexibility, adaptability and responsiveness of the command structure itself (see for example, Palin, 1995). For instance, an agile organisation should be able to exploit different C2 styles and structures, staffing, and organisational differences.

Ethos

Cultural and organisational factors were recognised as important to this problem space in the OIM (Clark & Jones, 1999) and in numerous other works such as Palin (1995). Dove and Hartman (1996) identify two human relations factors relevant to ethos, which they believe influence an organisation's agility. These include the quality of personnel, the growth of their skills and experience, and workforce diversity. These might be affected by recruitment and training policies as well as culture. Diversity may range over factors such as gender, age, and ethnicity balance, the competencies required, skills, experience, education and personal attributes such as their ability to accommodate cultural difference, and their ability to cope with uncertainty and ambiguity (Warne *et al*, 2004). In practice, a balance between diversity and uniformity is required so that performance and Resilience (or Depth of agility) are not sacrificed.

Not yet resolved is the question of what other forms of organisation and organisational culture facilitate agility and the relative importance of each in particular contexts. For example, some of the enablers of organisational learning could also facilitate OIA (Nonaka & Takeuchi, 1995; Senge, 1990) but the authors are not aware of any work to substantiate this in a military environment. Other enablers cited include an emphasis on multi-skilling, social competencies, cultural and communication skills such as networking and language facility and the ability to work, think and learn as a team. These may be related to an organisation's ability to adapt and change its structure. For example, they may be related to the organisation's ability to self organise, whether the organisational structure is scaleable facilitating different levels of deployment, and whether different cells or teams can be used according to the threat or tempo of operations. Trust and may also be an issue e.g. the ability to develop relationships and trust quickly to deliver services and the fragility of any trust previously developed between organisations.

The authors also believe that a commitment and willingness to operate with other organisations from across organisational and cultural groups is important. This includes a willingness to accommodate differences in goals and values, and being prepared to work with organisations with multiple conflicting goals. Also included is a willingness to share required information within an appropriate timeframe.

Levels

In order to develop a maturity model, it was necessary to develop a scale of Organisational Interoperability Agility from least to most agile, which in turn could be mapped to a set of levels for the attributes and factors discussed in the previous section. Three key attributes were focused on the organisation's willingness, experience, and openness.

0. Static. This level is characterised by a single way of doing things. There is one static set of partners, activities, and doctrine, with little or no willingness to change or accommodate differences.
1. Amenable. This level is characterized by a willingness to interact with different partners, activities, doctrine and culture, although there are no procedures in place to support change. The organisation is capable of working with several similar partners that all use consistent doctrine (such as the 5-eyes community) for a given set of activities.
2. Accommodating. This level is characterised by an ability to accommodate differences in partners, activities, doctrine and culture. It moves beyond willingness to work together, to a willingness to adjust to other organisations. Organisations at this level are starting to have experience working with, and developing doctrine together with a range of organisations and developing techniques for adjusting their doctrine.
3. Open. This level is characterised by experience interfacing with organisations with different partners, activities, doctrine and culture. Organisations at this level have a greater range of experience in working with a variety of other organisations, and with different doctrine (or flexible doctrine) and command arrangements. Recruitment policies, training, on-the-job experience and organisational culture reinforce this by, for instance, drawing staff from a range of cultures, having staff who are willing to work with organisations that have different goals and values and who have appropriate cross-organisational and cross-cultural experience.
4. Dynamic. This level is characterised by the ability to quickly and seamlessly transition between different ways of operating, using different doctrine and command and coordination arrangements as required, possibly in different parts of the organisation. The organisation is willing to accommodate differences in organisational goals and values and is able to share information to mutual benefit.

Model

The preceding discussions identified the attributes, factors, and levels that would be used in the OIAM. Table 1 shows how these attributes come together. Readers should note that each level builds on the level before. Thus, if the table does not indicate a change in a sub-attribute then the description from the previously numbered level applies.

Table 1 OIAM Levels and Attributes.

Level	Preparation (includes Understanding)	Command and Coordination	Ethos
4 Dynamic	<i>Compatible doctrine developed with at least one organisation across each organisational and cultural grouping and the ability to rapidly achieve this with most of the remaining organisations for each activity relevant to the context, and to adjust doctrine during operations.</i> <i>Wide variety of relevant collective experience working with other organisations across most organisational and cultural groups within a variety of contexts including for different operational types and cross organisational bodies relevant to the context.</i> <i>High awareness of future OI requirements OIA. Able to rapidly plan and train to achieve required OI levels.</i> <i>Mechanisms to work together and share information already in place and practiced with at least one organisation across each organisational and social/cultural grouping and the ability to rapidly develop them with other organisations across most organisational groups.</i>	<i>Mechanisms for interacting with management/C2 styles with at least one organisation in each organisational group and the ability to rapidly achieve this with most other organisations² within the context.</i> <i>Practice at timely changing C2 styles. Ability to exploit different C2 styles in different parts of the organisation and to adjust and exploit C2 structures, styles and staffing during operations.</i> <i>Ability to staff C2 structures from the whole organisation.</i>	<i>Willing to operate with any organisation in the context (including partners with which no formal doctrine has been developed). This includes a willingness to share required information with relevant individuals within most organisational groups and to share information across most information classes in recognition that a common purpose is being served.</i> <i>Willing to accommodate organisational differences and with experience negotiating with different organisations.</i> <i>Accustomed at adapting to changes in doctrine.</i> <i>Willing to accommodate differences in goals and values and with techniques for recognising a common purpose while working with organisations with multiple conflicting goals.</i>

² The management style of the lead agency may vary depending upon the type of operation, activity etc.

Level	Preparation (includes Understanding)	Command and Coordination	Ethos
3 Open	<i>Compatible doctrine/procedures developed with at least one organisation from most organisational and cultural groups i.e. the organisation has multiple sets of doctrine/procedures covering many activities relevant to the context.</i> <i>Aware of future OI requirements and have measures and metrics to support OIA.</i> <i>Have mechanisms to develop new workable doctrine/procedures with other organisations. Ability to develop doctrine for new activities in advance of operations.</i> <i>Considerable variety of relevant collective experience working with other organisations across most organisational and cultural groups.</i>	<i>Mechanisms for interacting with management/C2 styles with at least one organisation from most organisational groups.</i> <i>Familiarity with different C2 styles and structures. Ability to adjust C2 structures during operations.</i>	<i>Willing to operate with most organisations relevant to the context across all of the organisational groups and to share most classes of information with them.</i> <i>Willing to adapt to changes in doctrine and procedures. Practiced at gaining new skills. Encouraged to generate alternative mechanisms for interactions.</i> <i>Willing to recognising that a common purpose may exist while accommodating differences in goals and values and working with organisations whose goals conflict with each other.</i>
2 Accommodating	<i>Preparation for future OI is broadly based, but awareness of future OI requirements is still limited.</i> <i>For most activities relevant to the context, compatible doctrine/procedures have been developed with at least one organisation from most organisational and cultural groups i.e. multiple sets of doctrine/procedures have been developed.</i> <i>A variety of relevant collective experience working with other organisations across organisational and cultural groups.</i>	<i>Mechanisms for interacting with the management/C2 styles of organisations from across some organisational groups.</i> <i>Willing to adapt to different C2 styles. Able to adjust C2 structures before operations and C2 staffing during operations.</i>	<i>Willing to operate with at least one organisation from most organisational groups and to share some classes of information with them. Encouraged to develop new skills.</i> <i>Willing to develop new methods and procedures for interacting with the other organisations.</i>

Level	Preparation (includes Understanding)	Command and Coordination	Ethos
1 Amenable	<i>Preparation for future OI is ad-hoc, with limited ability to gather information about future requirements.</i> <i>For some activities relevant to the context, there is more than one partner organisation with which at least one set of compatible doctrine/procedures has been developed.</i> <i>Limited collective experience working with organisations from other organisational and cultural groups.</i>	<i>Acceptance of more than one command and co-ordination style.</i> <i>Mechanisms for interacting with more than one management/C2 style.</i>	<i>Willing to operate with a limited number of alternative partners e.g. partners without doctrine and to share limited information.</i> <i>Willing to adapt to minor changes in doctrine and procedures.</i> <i>Only willing to accommodate minor differences in goals and values.</i>
0 Static	<i>Almost no awareness of, or planning for, future OI requirements.</i> <i>For each activity relevant to the context, there is at most one partner organisation with which a set of compatible doctrine has been developed.</i> <i>Almost no collective experience working with any other organisational or cultural group.</i>	<i>Only one command and co-ordination style predominantly used and widely accepted.</i> <i>Unwilling to accommodate different C2 styles.</i>	<i>Not willing to operate with alternative partners e.g. partners with which no formal doctrine has been developed. Unwilling to change organisational structure or practices to accommodate others or share information.</i> <i>Generally unwilling to change goals and allegiances and accommodate different values.</i>

7. An Example

Sweden's increasing willingness to send troops abroad and the declining numbers of people participating in Sweden's "compulsory" conscription have had an impact on their OIA³. Historically, their focus was on Homeland Defence, and OIA meant being able to develop relationships with new Swedish organisations. Since Defence drew widely from the population for its conscripted force, many members of most organisations had participated in it and had a good understanding of Defence doctrine, command arrangements, goals and values. This resulted in the ability of the Swedish Defence Force (SWD) to rapidly develop new relationships with Swedish organisations of interest. In terms of OIA, this would raise their level of Preparedness as through the conscription process they exercised with people who would eventually work for other Swedish organisations. It would also raise their level of Ethos, as they drew widely from the population and their goals and values were familiar and may have become instilled in people who would eventually work for other organisations. Although the command and control attribute

³ This analysis is based on personal communications between Christian Carling, FOI and Gina Kingston, DSTO. It is not based on the analysis of historical data and thus is indicative only, so OIAM levels have not been assigned. Any errors remain the responsibility of the authors.

was probably static, they also changed their context, as most people in other organisations were aware of the SWD command and control arrangements and knew how to interact with them. The changes in both the focus of the Armed Forces and the move towards more selective conscripted forces would be expected to decrease the levels of both Preparedness and Ethos. This means that the SWD may now need to look to other methods for achieving a high level of OIA.

8. Future directions and A Way ahead

The future direction of OIAM development is relatively fluid; the paper has tabled the research conducted to date in the development of this high level model. Further refinement and development of associated metrics will be achieved when it is applied initially to case studies and later in field coalition activities. The OIAM is an assessment model focused on establishing a single organisation's *potential* to have agile interfaces to other organisations in future coalition operations. In the overall scheme of organisational evaluation a fully developed OIAM is only one, albeit a very important assessment tool available to the end user. The application of the OIAM in the field would benefit from supporting tools, some still in the developmental stages. The future direction of analytical research of complex organisations in a network centric paradigm needs to include tools that will support the application of the OIA methodologies

One method of supporting OIAM assessment envisaged by the authors, is first to establish an organisational reference model i.e. a model of those enablers of an agile and interoperable organisation as embodied in the form and functional design of the organisation. Second, to identify the organisational context in order to bound the analysis space, and provide a contextual baseline for comparative assessment. Third, to measure the organisational dynamics, those capabilities that enable it to quickly adapt, integrate and perform as a member of a planned, ad hoc or novel coalition while possibly involved in other concurrent national or multinational operations. This is complementary to the OIAM method which relies on the identification of the agility space (scope of considerations), the general nature of the organisation's task in the coalition and its ability to leverage off others, and contemporary (documented) evidence of an operation. This includes consideration of the effects of tempo and dynamics of operations, interoperability achievable with partners, lines of communication, distances and geography of the theatre, diplomacy and rules of engagement and the effects.

Having established the organisational reference model and then applied the OIAM provides a contextual baseline of the potential level of OIA achievable by the organisation's human capital employing those form and fit functional products. So the contextual baseline achieved is dependent on a high level of organisational synergy across technical, functional, procedural and human investment with the latter broken further down into such areas as trust, willingness, skill sets, training, understanding and experience. The importance of the human capital cannot be overlooked as it is their willingness and motivation in their professional undertakings, their keenness to nurture their professional social networks and level of trust across organisational and cultural boundaries, which determine the overall OIA level not forgetting the potential level of success of the coalition operation.

9. Conclusions and Way Ahead

This paper has presented an initial version of a maturity model for Organisational Interoperability Agility.

The OIAM developed here is a purely theoretical model intended to promote discussion within the CCRTS community. Other researchers may identify other factors that should be included in the model, and it needs to be validated and refined using observational data. In particular, the

decision not to include Understanding as an attribute, and the appropriateness of the levels (which normally reflect stages of maturity through which an organisation processes to obtain a desired capability) and their constituent elements needs to be verified. The concept of baselining using the OIA maturity model and producing not only a level of maturity but also a performance level needs further investigation. Historical and observational data could be used to assess levels using the current version of the OIAM; these could then be verified against independent assessments of OIA made by Subject Matter Experts. At the same time, some elements of the practicality of the model could be assessed, including the availability of the information, and the time required to make assessments. It should also be recognised that just as different parts of an organisation can have different interoperability levels, different parts of an organisation can be at different OIAM levels. The implications of this may also be investigated.

Once the model has been validated, the suitability of the model for predictive assessments needs to be assessed. Ideally, an organisation with a high OIA should be able to achieve and maintain a high level of OI as required. This requires the a-priori assessment of an organisation's OIA and assessment of that organisation's ability to develop and maintain OI in a new or modified relationship.

Finally, it should be recognised that the model does not attempt to define a desired level of OIA. There may be a cost and performance trade-off associated with obtaining agility (such as the overhead of maintaining multiple sets of, or diverse doctrine). Future work may consider when, where, and how much OIA is desirable for a military force in a variety of different types of operations.

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An Organisational Interoperability Agility Model

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Defence Science and Technology Organisation



Contents

- Introduction
- Background
- Requirements
- Methodology
- Results
- Further Research



Introduction: Organisational Interoperability Agility

- An organisation's potential to adapt their non-technical interfaces to deal with changing circumstances
 - In the environment
 - In the activities to be conducted
 - In coalition partners and roles
- Provides an agile contribution to a coalition, not necessarily agile on its own.



Background: Trends in Military Operations



- Unilateral operations are rare
- Coalitions are often formed on an *ad hoc* basis. They may be led by non-military organisations
- Coalitions are fluid - partners may rescale commitments
- Concurrent Operations
- Increase in operations other than war



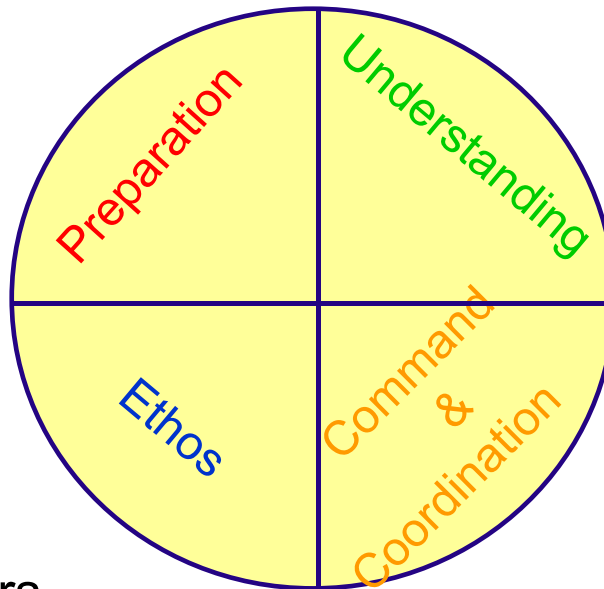
Background: Agility

- “The ability to adapt proficiently (thrive) in an environment of unpredictable change” (Dove and Hartman, 1996)
- The ability to create and utilize options (Smith, 2004; Hartland et al, 2004)
- Robustness, resilience, adaptation, responsiveness, innovation, flexibility (Alberts and Hayes, 2003)



Background: Organisational Interoperability Model

How well prepared are
collaborators to
perform the goals?



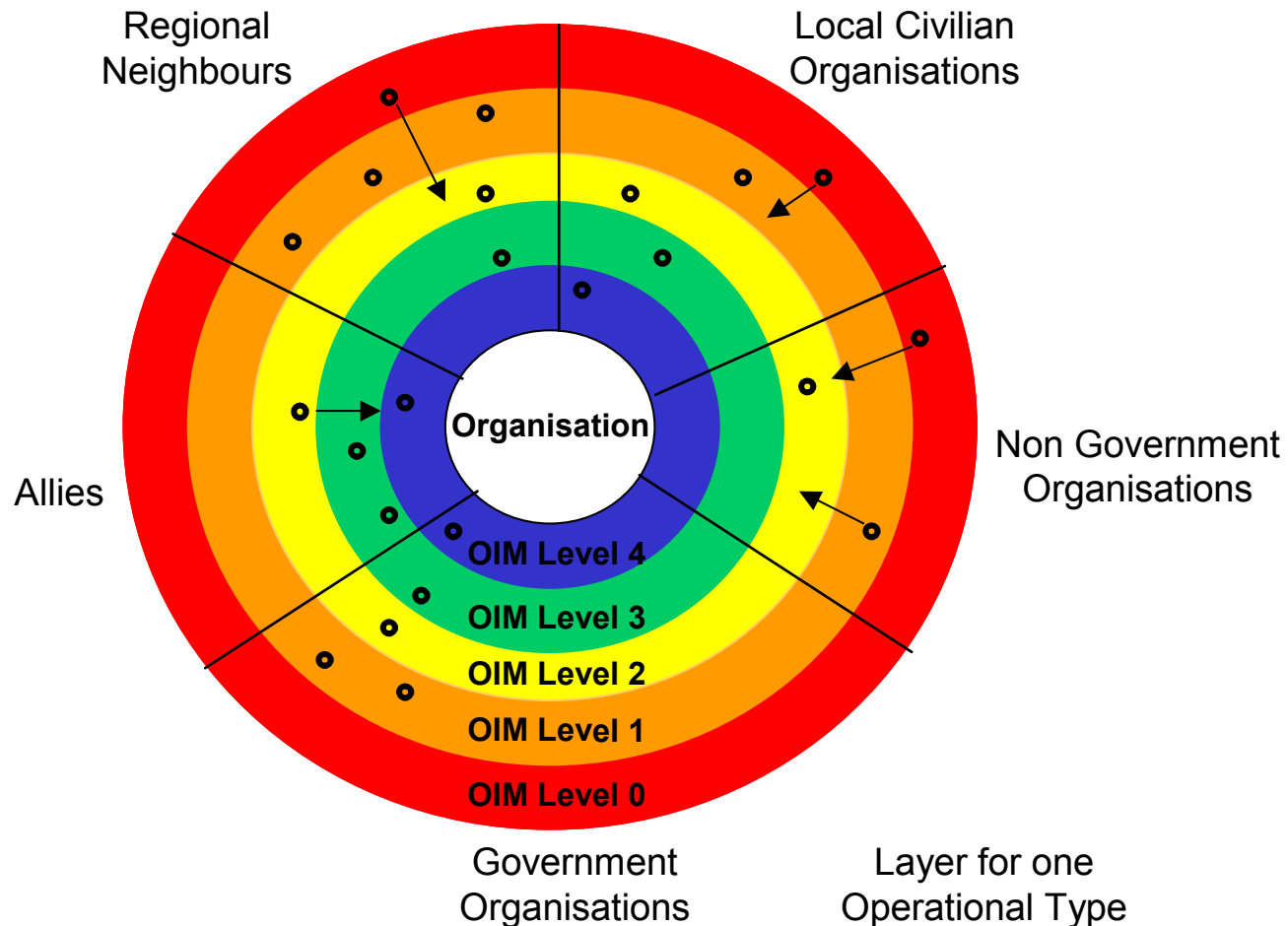
How well developed is
the level of mutual
understanding and
knowledge sharing?

What impact do
Socio-cultural factors
have?

How well do
collaborators fit into
the command
structure and adapt
to the command
style?

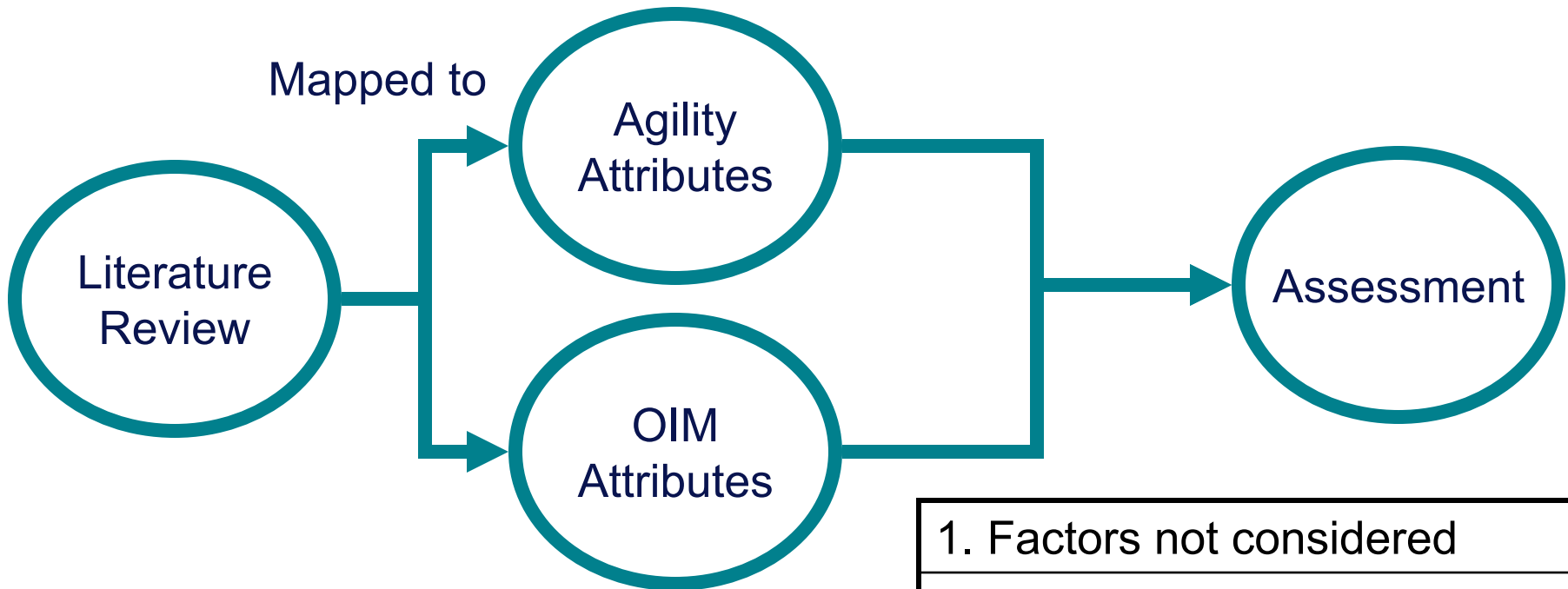


Requirements: Assessing Organisational Interoperability Agility





Methodology



- | |
|---|
| 1. Factors not considered |
| 2. Unique attribution of factors |
| 3. Hierarchy for achievement of attributes |
| 4. Related hierarchy of factors |
| 5. Dependencies between attribute levels and OIA levels |



Results: OIM vs Agility Attributes

Methodology Questions	OIM Attributes	Agility Attributes
1. Factors not considered	Most explicit in OIM.	Most based on judgment.
2. Unique attribution of factors	Some overlap with cultural issues in Preparation, Ethos and Understanding. Understanding subsumed.	Most factors related to several attributes. Agility attributes not independent.
3. Hierarchy for achievement of attributes	Two methods identified. Willingness, scope and achievement chosen.	Difficult due to the lack of an agility theory and nature of attributes.
4. Related hierarchy of factors	Readily mapped.	Difficult or impossible to map.
5. Dependencies between attribute levels and OIA levels	Lack of theory but significant experience with OIM enabled initial development.	Lack of theory and practice and above problems hindered development.



Results: Organisational Interoperability Agility Levels

Level	Description
4. Dynamic	Quick, seamless transition between different ways of operating. Multiple ways of operating within the one organisation. Willing to accommodate differences in goals.
3. Open	Experienced with different interfaces, reinforced by culture.
2. Accommodating	Able to accommodate differences in partners. Willing to adjust own organisation.
1. Amenable	Willing to interact and capable of working with similar organisations.
0. Static	One set of partners, activities and doctrine.



Results: Organisational Interoperability Agility Attributes

Attribute	Description
Preparation	Preparedness of the organisation to interoperate. This includes the doctrine i.e. the rules and practices that will apply, as well as the degree of previous relevant training and experience.
Command and Control	How well the participating organisation fits into different command structure and adapts to different leadership styles.
Ethos	The cultural and human factors including the quality of personnel, willingness to accommodate differences, and culture of learning, innovation and change.



Results:

Organisational Interoperability Agility

Level 3 (Abbreviated)

Preparation	C2	Ethos
Multiple sets of doctrine/procedures covering many activities relevant to the context. Aware of future OI requirements and have measures and metrics to support OIA. Ability to develop doctrine for new activities in advance of operations. Considerable experience working with other organisations	Mechanisms for interacting with most management/C2 styles relevant to the context. Familiarity with different C2 styles and structures. Ability to adjust C2 structures during operations.	Willing to operate and share most information with most organisations relevant to the context. Willing to adapt to changes in procedures. Practiced at gaining new skills. Encouraged to generate alternative mechanisms for interactions. Willing to recognise common purposes with organisations whose goals conflict with each other.



Additional Research Required

- Gain feedback on OIAM from other researchers.
- Develop a methodology for applying the OIAM.
- Validate OIAM.
- Determine predictive power of OIAM.
- Determine desired levels of OIAM.