Requirements Analysis for effective operations management in the modernization of defence forces

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Abstract

In 2009, the Australian Army implemented the *Adaptive Army* initiative following a wide-ranging review of the higher level command and control frameworks. The key concept in this change is to provide for industry engagement within modernisation. At the outset, it is necessary to have an understanding of the nuances associated with the terms *modernisation* and *capability*. This paper utilises a case study approach to hypothesise and examine the validity of the key concept. Through this research, the stakeholders, benefits for both army and industry were identified and an engagement architecture was proposed.

Keywords: defence forces, modernization, capability lifecycle, requirements analysis, industry engagement

Introduction

In 2009, the Australian Defence Force (ADF) implemented the modernisation initiative following a wide-ranging review of the higher level command and control frameworks. The previous operation structure had been in place since 1973 and was more reflective of a Cold War approach. Change was principally driven by an increasing focus on the supporting mechanisms that arose in response to the ongoing deployment of force elements to operational requirements, particularly East Timor and the Middle East (Gillespie, 2009).

Pursuant to this concept are a number of white papers by the government over half a century. More recent ones include the white papers in 1994 (Commonwealth of Australia, 1994), 2000 (Commonwealth of Australia, 2000), 2009 (Commonwealth of Australia, 2010) and 2013 (Commonwealth of Australia, 2013).

Based on these white papers, the Defence's Strategy Framework (Commonwealth of Australia, 2010c) sought to modernise defence by synchronising the formulation of strategic guidance and other elements including capability development across Defence. The key concept was to leverage off industry expertise. Although concept development was consultative and collaborative, it depended on key stakeholders in the defence sector. A typical defence capability acquisition project has four phases as shown in Figure 1 (Mo, 2012). Traditionally, the requirements and acquisition phases are handled by a specialised capability group within defence organisation, or assigned to a less

defence oriented acquisition agency. Unfortunately, this practice has significant risks in delays and misinterpretation of the real capability requirements.

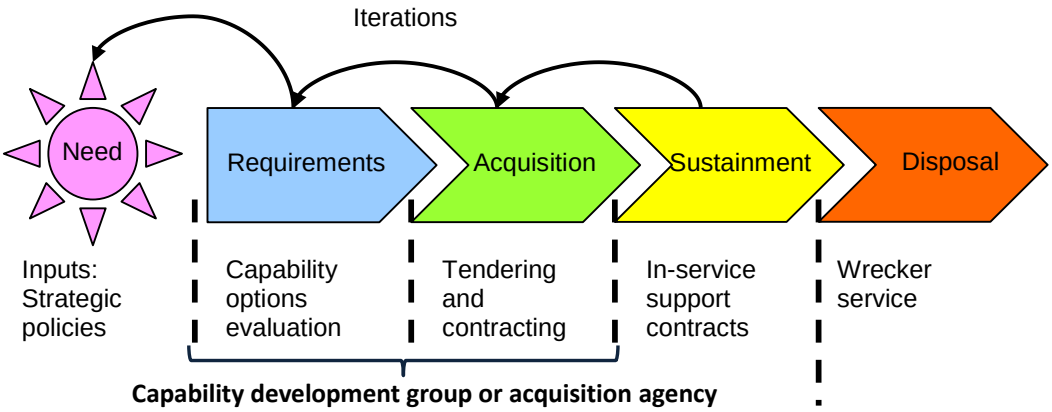

Figure 1: Defence capability systems lifecycle

The primary goal of the defence capability systems lifecycle is to ensure an open process that can attract the best possible offer from industry. In developing the capability system, the sustainment requirements are often ignored due to the need for additional acquisition funding that may be objected due to political reasons. This presents problems to the modernisation effort if the strategy is engage industry in the delivery of a new capability or enhancement to extant capabilities (Fortune, 2014). Internal defence stakeholders failed to incorporate external sources and agencies for some reasons.

Defence can only implement modernisation strategies through an industry supply chain (Mentzer *et al.*, 2001). This paper analyses the requirements for effective operations management in modernisation. This research adopts a case study approach to initiate three hypotheses to guide the investigation. Using facts and data from 17 case studies, the industry engagement strategy has been proved to be a viable and necessary development. Furthermore, the research shows that to optimise the outcome of this strategy, an engagement architecture is proposed.

Literature review

The military supply chain consists of seven components which are slightly different from the manufacturing industry perspective i.e. suppliers, procurement, manufacturing, order management, transportation, warehousing and customers. The requirements for Defence to implement supply chains are very different as its focus is on missions rather than overall functioning of the organization. Figure 2 shows a concept model of an army supply chain management. Key processes such as transportation, distribution, and warehousing are unidirectional in the corporate model but dual directional in the military model. The external factors which influence the supply chain in army are end-user need, Defence regulations, environment, joint interoperability, deployment within and outside the continent, mission requirements. The supply chain model reflects the Army's focus on mission accomplishment as opposed to business' focus on profitability.

Engagement between Defence and Industry has been an increasing feature of Defence White Papers. The term engagement is commonly understood as an interaction or ongoing interactions between parties (Smith, 2011). However, Defence's rigid adherence to probity served to stifle the ability to develop long term trusted relationships with industry (Parker & Hartley, 2003).

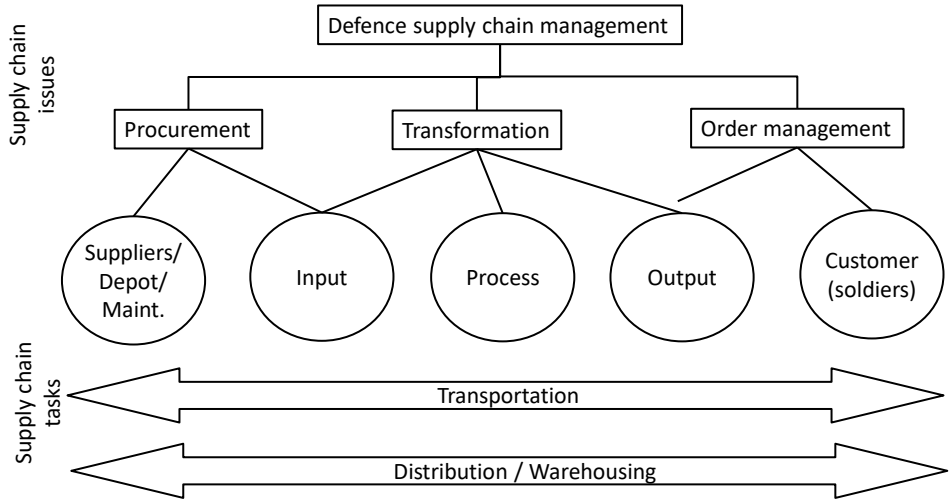

Figure 2: Army Supply Chain Management

Industry associations not only provide Industry representation, but a mechanism which facilitates the passage of information between industry, Defence, agencies and other sources. An example of this is the American defence industry where hegemony is not only demonstrated through a physical manifestation of bothy capability and capacity but also through its Industry associations (National Defense Industrial Association, 2018).Although Australian industry associations may not have the same strength of membership, the cited disunity has dissipated. The Australian Industry & Defence Network (2018) was established in 1995 and with similar aspirations.

These reviews show that irrespective of a visible level of industry engagement, Defence and industry relationship varies between industry groups and often project specific. A holistic approach is required to be developed to maximise the strength and mitigate the weaknesses through a systematic investigation.

Research methodology

This research project will utilise case studies which provides a method to investigate contemporary phenomenon within its real-life context. Case studies have a distinctive place in evaluation research and are a method of learning based on a comprehensive understanding that is developed from an extensive description and analysis of the phenomenon under investigation (United States Government Accounting Office, 1990). Yin (2017) demonstrated four stages in case study research, i.e. explanation, description, illustration and enlighten. The most critical to this research is explanation which seeks to explain the presumed causal links in real life interventions which are too complex for survey or experimental strategies.

The case study design methodology in this research is a multiple-case (holistic) design. The initial stage of explanation is linked to replication which involves selecting cases with prior knowledge of the outcomes and focussing on how and why the outcomes may have occurred. In this research, an initial set of case studies is used to determine the most important factors in Defence and industry relationship. The description stage evaluates the implications of the initial case studies and hypothesises goals for further analysis. Multiple case studies are then used in the illustration stage to validate (or invalidate) the hypotheses. Finally, the enlighten stage draws conclusion and recommendation from this research.

Initial case studies

The initial set of case studies has 5 case studies drawn from a range of sources including both academic and defence literature. The case studies are labelled CS*x*.

CS1 – Vos & Achterkamp (2006) suggested that within innovative areas, identifying those stakeholders to be involved is the first challenge of stakeholder management. There method required the development of a classification system that enabled the determination of the specific category into which the potential contribution could be allocated. This in turn necessitated matching those contributions to the particular innovative areas being developed.

CS2 –Following the cancellation of the project Future Combat System, the United States Army has developed the Ground Combat Vehicle project. Included in this was the capitalisation of investments made in the cancelled Future Combat System which had matured a number of critical vehicle technologies called the 'MGV Body of Knowledge'. Army subsequently made these technologies available to Industry as part of progressing the planning and development of the Ground Combat Vehicle project (Casey, 2010).

CS3 – Pernin *et al* (2012) found that US Army needed greater technological assessment and analytical capabilities. The development of the Future Combat System was based on a fictional future scenario which was generally set in the 2015 – 2025 timeframe. This contributed to the *solidification* of the concepts. Subsequently, when interpreting the outcomes of war-games, Army's resultant assumptions concerning the future environment became critical to the design and operation of the Future Combat System.

CS4 – The Rapid Prototyping, Development and Evaluation program originated in 2005 as a means to assist the development of Network Centric Warfare within the ADF. Since then, its role has broadened to address many areas throughout Defence with a specific focus on warfighting. There are two forms of solution based product provided by the program. The first is a Quicklook that delivers guidance, advice and input on a Defence issue which is normally delivered within three months. The second is a Task that delivers a prototyped solution in 12–18 months. The program also includes Academic engagement within its remit (Rapid Prototyping, Development and Evaluation, 2017).

CS5 – The Capability Development Advisory Forum invited Industry representatives to meet with Defence management to (1) Make Australian Industry an integral part of the capability development process ensuring that Industry aspects are considered early, appropriately and consistently; (2) Provide a vehicle for Industry representatives for the discussion and promotion of capability development considerations regarding national interest, (3) Enable Defence to assess capability proposals. It is a mechanism for on-going interactive engagement amongst the membership (Commonwealth of Australia, 2006).

Hypotheses from the initial case studies

Government has recognised the inherent link between Australian defence Industry and the foundations of self-reliance within defence policy. Government's strategic guidance has sought greater Industry and Defence engagement but it remains procurement focussed and beyond the Needs Phase of the Defence Capability Systems Lifecycle. The initial set of case studies suggests five research questions:

[1] Who are the stakeholders within Industry and Army engagement in the identification of needs? (CS1)

[2] What are the benefits for Industry in assisting Army to identify? (CS6)

[3] Why should Army seek Industry assistance to identify needs? (CS10)
[4] How can Industry assist Army to identify needs during the development of modernisation concepts? (CS17)
[5] What methods optimise the identification of needs? (CS22)

Three hypotheses can be constructed from the five case studies as shown in Table 1. It is noted that RQ2 and RQ3 are two sides of the same relationship. RQ4 and RA5 are different aspects of Defence industry engagement. These research questions are explored under the same hypotheses.

Table 1 – Research questions leading to hypotheses

RQ	CS	Case study indication	Hypotheses
1	1	The identification of stakeholders is a key aspect to successful Industry engagement as effective stakeholder contribution is beyond simple organisational representation.	H_1 – Effective contribution is necessary for productive Industry and Army engagement
2	2	The provision of information is a significant aspect for Industry engagement with Defence as it facilitates an understanding not only of requirements but the opportunity to incorporate knowledge and associated environmental factors.	
3	3	Industry has an objective analytical ability and remains external to the internal machinations associated with a military hierarchy.	
4	4	There are a number of ways that Industry can assist Army in the identification of needs however this discussion will not attempt to cover the field.	
5	5	Continuous engagement at suitable level provides a mechanism for on-going enhancement of defence-industry relationship	

Illustration of hypotheses

More case studies are collected and categorised according to the research questions. Solutions suggested in the case studies are identified and associated with the hypotheses in order to draw out conclusion. The results are shown in Table 2.

Table 2 – Case analysis against hypotheses

Hypo-theses	Illustration case studies
H_1	**CS6** – Haas and Hansen (2007) found that the quality of engagement was improved by personal involvement and knowledge. **CS7** – Boesso and Kumar (2009) highlighted managerial attitudes within stakeholder relationships was relevant within the military domain where nexus between prevalent social values and organisational legitimacy was important. **CS8** – The North Atlantic Treaty Organisation's Smart Defence initiative allocated responsibility for the management of information and for keeping it current, useful and readily available to stakeholders (Taylor, 2012).
H_2	**CS9** – Defence is traditionally a monolithic customer, for example it procures large amounts of capital equipment from a single source which remain in service for extended periods. This has implications for Industry particularly not only from the *peaks and troughs* of demand but the significant technological advances in between (Ferguson, 2012).

Hypo-theses	Illustration case studies
H_2	**CS10** – One of the core issues driving Industry's working relationship in the Smart Defence initiative is the North Atlantic Treaty Organisation's role in supporting the identification and creation of a potential market for Industry's products and service. It presents an opportunity for Industry to be proactive by focussing strategic marketing efforts on developing products and projects that support the Smart Defence initiative. (Heidenkamp, 2012). **CS11** – The Australian Army has developed three centres with a focus on integration and particular emphasis on the *warfighter:* Diggerworks, the Land Network Integration Centre, and the Combined Arms Fighting System Integration Centre. (Jennings, 2017). **CS12** – One of the risks that has been identified is Army failing to recognise the time required to take full advantage of an intellectual approach in achieving integration (Caligari, 2011).
H_2	**CS13** – The opportunities for early identification of enterprise architecture needs are enhanced through the increased presence of Defence Primes operating within Australia (Commonwealth of Australia, 2016). **CS14** – Integrated logistics and in-country support of Defence systems is an area of strength for which the Australian defence Industry has world recognised capabilities (Ward, 2012).
H_3	**CS15** – During the development of the Ground Combat Vehicle project, the United States Army undertook a series of Industry days which provided the Army's development intent and gained feedback from potential contractors. In response to these initiatives (Feickert & Lucas, 2009). **CS16** – The Australian Industry Group (2018) has identified that maintaining the capability edge for the Australian Defence Force will become more demanding. In addition to this, the actual scale of advanced technological expertise required to implement Government's capability priorities is unprecedented. **CS17** – In the lead up to the 2013 Defence White Paper, the Australian Industry Group recommended a more focussed approach to defence Industry development in order to provide greater support to the Australian Defence Force as well as sustainment of indigenous industrial capability and related skills (Skills Australia, 2012).

Requirements analysis

This analysis is based on the explanatory approach provided in the case studies. It seeks to support the requirement for Army to integrate Industry knowledge and subject matter expertise in the identification of needs during the development of modernisation concepts necessary for capability development. The discussion is aligned with the Research Objectives through three broad approaches: Stakeholder Engagement, Mutual Benefits, and Engagement Architecture. Within Engagement Architecture, Perdue Enterprise Reference Architecture has been investigated to determine its suitability as an enterprise architecture for Industry and Army engagement.

Stakeholder management is a fundamental aspect of achieving effective Industry engagement. Management should be understood to include aspects beyond the actual process and include attributes such as values and attitudes of participants within the process. Without acknowledgement or potential ownership of these management issues, Army risks a disjointed approach particularly given the complexity associated with capability development both from a technological and integration perspective. This is reinforced by the need for Army to maintain organisational legitimacy in approaching needs identification through Industry engagement.

One of the significant aspects of engagement is the ability to facilitate mutual knowledge sharing that informs not only capability development but the parties involved therein. An important aspect of knowledge sharing is developing an understanding the actual requirements of the parties involved. The United States Army's Network Integration Evaluation initiative acknowledges this and provides a methodology at the front end of capability development for Industry and Army to identify these requirements.

Linked to both knowledge sharing and integration is innovation. Innovation is rapidly becoming the catch cry of defence Industry as has been highlighted by both Government and industry particularly in regards to the implementation of capability priorities. Industry engagement within capability development affords an opportunity to establish closer ties with Defence and inform Industry's innovation effort.

An area that is yet to be explored in any great depth is Industry's analytical ability. The conceptual foundations of the US Future Combat System (CS2) were derived from a series of war-games and future based scenarios. Ultimately, these were shown to be erroneous from the perspective of requiring greater technological assessment and analytical capability. Defence industry, particularly primes, operate within a global environment and can provide a source technical and market analysis, potential collaboration opportunities and capability development lessons.

The foregoing discussions are categorised according to the hypotheses and some prediction could be drawn as shown in Table 3.

Table 3 – Summary of research objectives, questions and hypotheses

Hypo.	**Prediction**
H_1	If stakeholder participation is valued, engagement will be consultative and collaborative beyond commercial orientations.
H_2	If engagement is mutually beneficial, then modernisation effort and capability development will be enhanced beyond dependency on a systemic relationship.
H_3	If information influences modernisation concepts, then engagement with Industry will enable exploitation of emergent trends which are otherwise dependent on internal sources.

Development of engagement architecture

The RAND analysis of the Future Combat System highlighted the importance of ensuring concepts are technically feasible well before any project commencement. Included in this were a number of considerations that provide an understanding in determining this feasibility. These are of particular benefit within this discussion as they identify factors that should be incorporated within Industry engagement activities including Industry led engagement. From a practical perspective however, an associated risk is *engagement fatigue* especially in an environment whereby the nexus between actual participation and a definitive result is unclear.

An engagement architecture provides a descriptive framework and an associated methodology for planning and executing the necessary tasks in order to produce an actual enterprise such as Industry and Army engagement in the identification of needs.. The development of an engagement architecture is beyond the scope and time available for this research project however, engagement methodologies have been used to inform the potential application of the Purdue Enterprise Reference Architecture to industry engagement in the identification of needs (Mo *et al*, 2006). Shown in Figure 3 is an indicative enterprise architecture adapted from previous work in the Royal Australian Navy.

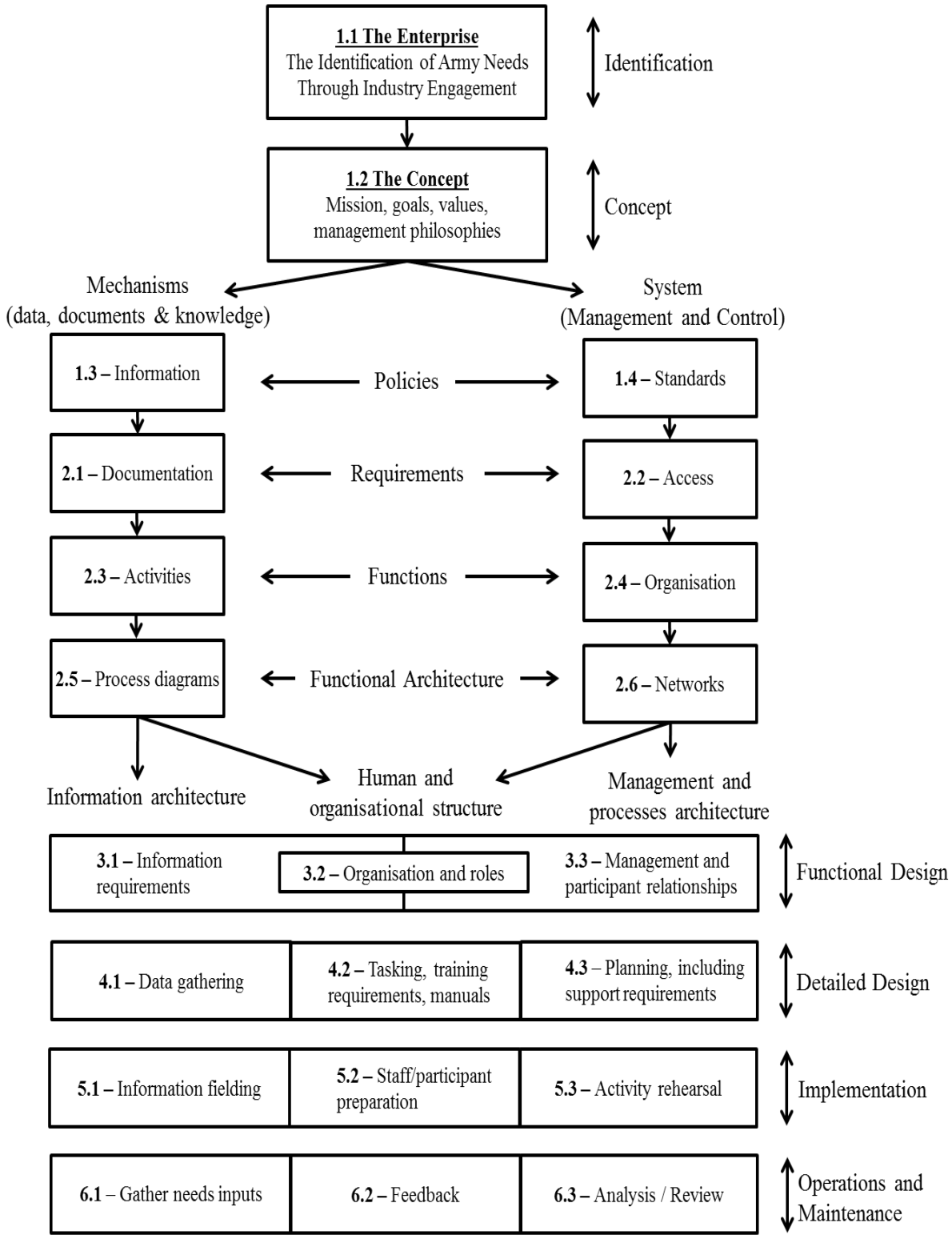

Figure 3: Enterprise Architecture for Industry and Defence engagement

Conclusion

The implementation of modernisation and strategic planning is based on a concept-led capability-based approach, which has called for extensive industry engagement. However, there is no definitive precedence of how and what this approach would look

like. This research illustrates a systematic methodology of analysing prior cases to develop the requirements of Defence and industry engagement for properly managing the project leading to modernization of the ADF.

By a case study research methodology, three hypotheses were postulated from five research questions. Multiple case studies were used to evaluate the validity of these hypotheses.

The research identified that similar issues have arisen in other Defence forces. Industry engagement will benefit both Defence and industry and this relationship could be best managed through the guidance of an engagement architecture. A preliminary structure of the engagement architecture has also been modelled from previous experience in the Navy.

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