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Embedding Ethics in Systems Development

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Abstract

In systems development practice both ethics and quality are sometimes seen as optional extras. This paper presents an argument that both ethics and quality can be effectively embedded in the systems development rather than being seen as aspects that are ancillary to the main task. It then presents a method for achieving this embedding that has been found effective in educating project managers.

Keywords

systems development, quality, ethics, responsibility

Introduction

Producing good quality systems using good quality processes ought lead to beneficial outcomes all round and praise for the developers. Blame is deserved for systems failures resulting from carelessness, ignorance, complacency or other irresponsible attitudes.

Praise and blame are hallmarks of ethical judgments, but in systems development they are usually discussed in terms of quality, not ethics.

Perhaps explicitly building ethical principles into quality assurance is a way of both practically implementing aspects of the ACS Code of Ethics and also giving some stronger foundation to Quality Assurance. We will look at this idea by first considering Quality Assurance, then Ethics and lastly looking at a method of integrating aspects of each into the teaching of systems development.

Quality Assurance

A 'product - process' model (Figure 1, after McDonald, 2007) can be used to put the idea of quality into the systems development context. This simple model identifies five aspects of development activity:

Process. The model applies at any level of process, from that used to build an entire system to some task that is a small part of the construction process. Every process is executed in an organisational context that by culture and power influences the process. Each process uses resources including the knowledge of staff, tools and techniques, procedures, etc and may be constrained by policy, history and so on.

Input-output or 'product'. This aspect identifies that every process has documents of some kind as input, perhaps a specification or work request. Every process produces documents of some kind as output, perhaps a manual or a code module. The output of one process is usually part of the input to another.

Management. The planning of the process, including the traditional features of the Project Management Body of Knowledge (PMI 2000, Schwalbe 2005) needed to plan, monitor and review the process.

Governance. The overall governance of projects provides the investment decision, strategic level monitoring and eventual benefits realisation of projects.

Quality. Four points of quality assurance are identified - quality of information coming in to the process, process quality, output product quality and impact quality.

Conformance with relevant standards and good development practice is one classic means to assess quality (eg. AS/NZS ISO 9000). This method can be applied to both the process and product of systems development tasks (ISO/IEC 15288, 2000). 'Fitness for Use' is the second common quality measure. It concentrates on the relationship of the product with the actual user, that is, it views the product as tool. Early views on 'fitness for use' were expressed by the ergonomics and cybernetics communities. But there is a third, less common measure - what are the impacts of the system over and above its fitness for use? In the end, the quality of the systems we build is determined by the impacts they have on people, organisations and society.

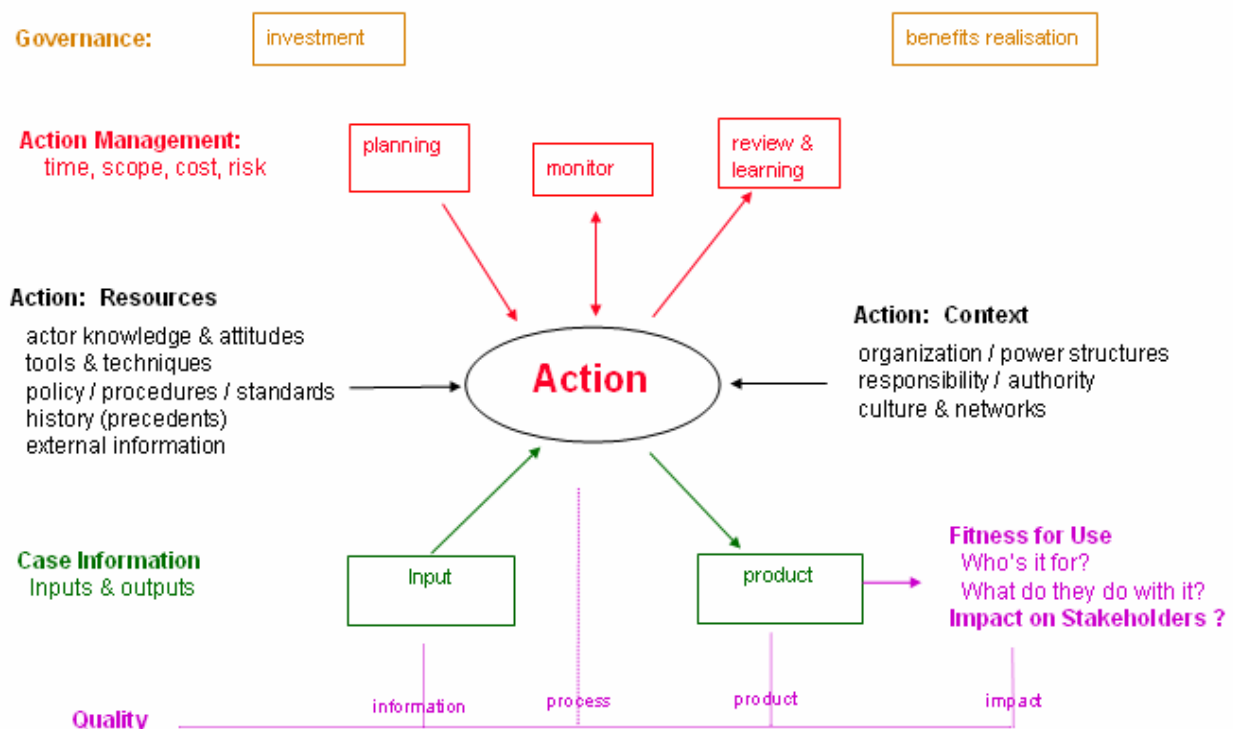


Figure 1: The Product Process Model

Quality Assured work is "evidence-based". That is, there is evidence that quality of the work has been explicitly defined and measured. Both the process and the product have quality attributes and in a quality assured project measurements of these attributes are recorded, the processes auditable and the product itself testable. It is said that 'if you can't measure it, you can't manage it'. But of course not all quality attributes are quantitative. Some of the most important qualities have to do with perceptions and values. Take the quality 'fits well with the strategic direction of the organisation'; while this quality attribute cannot be measured, it can be argued for (or against!).

While there are general quality standards, 'quality' always relates to some specific object, event or impact. General ideas about what to measure (correctness, modifiability, testability, usability, reliability, efficiency, integrity, reusability, interoperability, etc.) can be useful guides but each unique product, process and impact needs its own quality criteria to be established and satisfied.

This proposition leads to the idea that every single product and process needs to have embedded in it the means to assess its own quality. Imagine for instance each object in an object-oriented system having not only its own data and services, but also its own methods of evaluating itself.

We return to quality shortly.

Ethics

There seems to be three main kinds of discussion about ethics and ICT. The first tackles particular issues, like workplace surveillance or copying software, and examines the ethical principles that might apply to them. Laws are framed from this kind of discussion so it is critically important.

The second kind of discussion looks at specific events, real or made-up. Particular situations throw up unusual ethical aspects and dilemmas that highlight the complexities of ethics. For example, the set of ACS ethics cases reveal the complexities and contradictions that are inherent in ethical considerations of the particular situations we all find ourselves in sometimes (<http://www.acs.org.au> and search for 'code').

The final kind of ethical discussion starts from first principles and sees issues and events as applications of ethical principle. For example, if the principle of 'the greatest good for the greatest number' were to be applied to a situation, how would we measure 'good', can we add it, how could we balance the good to one person against that to another, etc. Despite such problems, the first principles approach that has given us a valuable practical tool for ethical evaluation - stakeholder analysis.

There are different kinds of stakeholders (Pouloudi 2000). Those that can terminate the project (financiers and clients) are most obvious. The stake they hold has sometimes been likened to a garden stake - sharp ended and potentially lethal! The next stakeholder is like a gambler who is part of the game, who knows the rules and whose stake is a pile of chips to bet with. Unions, insurance companies, regulators and so on are in this category. Then there are the victims; they are the ones who are impacted by systems in which they have no say. And lastly the voiceless stakeholders - the society at large, the economy and the environment (Bowern et.al. 2004)

So, it seems that the affects of our systems on our stakeholders is a core idea behind both Ethics and Quality. Systems developers are at the sharp end of these issues because their work has significant and wide-spread impacts on others. It is an ethical as well as a quality stance to care about the affects of our actions and to take responsibility for them.

Of course there are limits to what we can be responsible for. Bittner & Hornecker (2002) argue that to have responsibility for an action (or not taking an action) in some situation, a person needs to have an element of voluntariness, autonomy, foresight and there needs to be a causal influence between the action and the effect. Complex organisations & large systems diffuse and disguise responsibility. It is difficult for one person to take responsibility as effects emerge from a mix of actions and interactions that can't be attributed to a single person. Also technology and the division of labour in systems developments means that responsibility for certain components may be clear, but liability for the whole is less clear.

Nonetheless, if each of us embedded the responsibility idea into our actions the overall quality of systems would improve.

Embedding Ethics and Quality in Systems Development

One way to embed both quality and ethics into our systems is to explicitly cater for exactly who will be impacted by the process we are involved in and the product we will deliver.

At the University of Canberra we are trying to embed this recognition in our computing education by having students specify quality criteria for each development process and deliverable they engage with. PMSS is a computer system used to support our systems development and project management units. It has the usual facilities for planning and monitoring development, tracking issues and risks, organising meetings and for communication and configuration management.

PMSS also contains a set of templates for typical project documents. Figure 2 shows the deliverables page of our Project Management Support System. Notice that these templates are organised by stakeholder type. The interests and responsibilities of these stakeholders are the key to developers doing work that is both good quality and ethical.

Project Management Support System

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Menu

- Home
- About the Project
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Deliverables Addition

[Add Your Own Deliverables](#)

Available Deliverables

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 - Presentations
 - Installation Plan
- Re-Developers
 - Architecture
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 - Test Pack
 - Interface Design
 - Database Design
 - Object Models
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 - Owners Manual
- System User
 - User Training
 - User Reference
- System Manager
 - Systems Manual
- Business Manager
 - Document Designs
 - Process Designs

This site is best viewed with version 5 web browsers and above. And

Figure 2: Deliverables page of the Project Management Support System

At the start of a project, typical stakeholders include the following a) The project team itself, which is responsible for the professional conduct of the project and for meeting the needs of the team members; b) The re-developers, those who have to understand and change the system in the future; c) The system/business owner, who as an investor expects to benefit from the returns the system brings; d) The system's immediate users, who interact directly with the system and who have to adapt to the changes it brings; e) The systems manager responsible for the operations of the technology including security, backups, etc; f) The business manager, who administers the departments in which the system has been implemented.

Of course, as each project is unique, the range of stakeholders diverges rapidly from the typical case. But if the principle of catering to all stakeholders is sound, then lessons learned from typical cases can be applied to each new situation.

To implement quality assurance in the PMSS, each template has a set of quality criteria built in as the final section of the document. The idea is that every process and every product should have its specific quality criteria made explicit. Figure 3 shows an example of this section from a System's Owners Manual.

SYSTEM OWNER'S MANUAL	
1. Contribution to Strategy	2
2. Measuring Systems Performance	4
2.1 EIS facilities	
3. Benefit Realization	6
4. Risk Management	7
5. Audit, Legal and other Compliance Issues	8
6. Quality Assurance	9

6. Quality Assurance

The purpose of this manual is to address the interests of the system's owner by describing the facilities in the system and other methods that the owner can use to ensure the system is meeting needs.

6.1 Stakeholder Validation

This people affected by this product, and their interests, are:

Owner: benefits realisation, manageability

Line Managers: responsibilities, skills, reporting issues

Board: Governance issues

6.2 Process of Document Development

This document was constructed from

meetings with the client (see minute s..)

meetings with line managers (see minutes ...

a review of text books (see Thomsett..)

comparing with the content of other systems owners manuals

6.3 Traceability

Other documents that are related to this is are:

Project Charter - the agreement that specified the scope and character of the system

Business Managers Manuasl - operational details about workflow

6.4 Verification

This document was tested against other owners manual.

Simulation was used to test the owner's facilities under unusual situations (see test pack ...).

Line managers tested the EIS for accuracy (test ...). Usability was examined (Test ...)

6.5 References

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Thomson Learning

6.6 Document History

Figure 3: Quality Assurance Section of a System Owner's Manual

The System Owner's Manual may be created for upper management level executive responsible for the business area in which the system is installed. The opportunity to design executive level facilities into operational systems is often neglected in favour of more mundane data processing aspects. The very existence of this template in the PMSS raises the awareness of the student developer that she has to actually consider the executive level in the environment that surrounds her technical designs. Similarly, system's technical manager, as a stakeholder, needs diagnostic facilities built into the system in order to be equipped to carry out their task.

Once the student developer recognises that each stakeholder deserves explicit individual consideration, the scene is set for responsible and quality design work.

The assessment of student's work reinforces the idea of embedding ethics and quality into their systems development work. The assessment is conducted this way:

1. Product and Impact quality is examined from the standpoint of each stakeholder including:
 - system owner - how do I know I am getting the benefits promised?
 - various operational users - can I use this system?
 - line manager - can I better manage the workflow of this business process?
 - external stakeholder - am I being affected, perhaps by doing work that used to be done internally, or carrying risk?
 - next developer - can I modify the system easily
 - systems manager - can I ensure the stability, reliability, resilience of the system?
 - auditor - can I examine the system ?The academic is in the role of auditor in the assessment of the project.

2. Process quality is examined using the evidence collected in PMSS of project planning, modification and review; team management; communication, information & configuration management; and risk prevention, detection, and correction.

3. Student's individual reflection and their assessment of the contribution of their peers is coupled with reviews from clients and other stakeholders. Finally, the tutor's review focuses on the innovation and creativity students bring to the task, their perception and insights and the way they have built their own learning and development into the process of system development.

The PMSS is set in an educational context. But it points a way forward to a practical embedding of ethics within the quality framework of systems development. And it gives a grounding for why quality assurance can be much more than a management overhead in systems development.

Conclusion

Quality and Ethics go hand in hand. Every time we question the quality or ethics of a process or product we improve the system of which it is a part and we improve our own personal capability to do the right thing. These improvements are not trivial.

Being responsible for your action (or inaction) involves knowing who will be affected by your action, knowing the affects, caring about them then acting. A responsible person is prepared to accept the praise or blame.

This paper links ethics with quality then presented an argument that both can be effectively embedded in the systems development rather than being seen as an optional extra, external to the main game.

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