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Managing emergent information systems: Towards understanding how public information systems come into being[1]

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Abstract. The introduction of information technology is often considered to be important for increased organisational performance. Yet, in the public sector, regularly promised results do not (fully) materialise, and the actual systems delivered deviate strongly from those intended. In the literature, two perspectives are used to explain these outcomes: infighting in the initial phases of an information system's life, and continuous adaptation of the technology during its use. These perspectives are based on the awareness that mutual structuration between social and technical elements is a core finding in the analysis of system development. This awareness, however, has been translated into only one dominant paradigm for system development. In this article we argue that structuration leads to different means of intervention. In the initial infighting perspective the main concern with regard to influencing the information system is one of the inclusion of stakeholders and user groups in system design. These recommendations have to a greater or lesser extent found their way into systems development and design. Yet, the initial infighting perspective leaves the question unanswered as to whether, in the long run, information systems remain stable or whether ongoing changes and re-invention determine the way systems work out. Obviously, if the latter holds true, identifying the sources of change and monitoring the direction of actions in the workplace during the entire life of an information system are a necessary addition to the inclusion of stakeholders in its initial phase. In this paper we apply both perspectives to empirical material on the introduction of the information system 'GMS' in emergency rooms in the Netherlands. By doing so we try to establish which perspective should be applied and under what circumstances, and thus what path to intervention should be chosen.

1. Introduction

Dial the emergency number and you get the emergency room. It is operators working in this specific type of call-centre [1] who often provide the first contact between the citizen in distress and police officers, fire brigades and ambulance services. And not only do emergency rooms provide contact, they also structure quite a large part of the emergency room operators' work. From 1993 onwards the Dutch government aimed to get the police, the fire brigades, and the ambulance services to communicate using a joint communication and information system. The following year a start was made on merging their emergency rooms, and equipping these with a common emergency room information system (Geïntegreerd Meldkamersysteem, acronym: GMS). As part of the same policy, the design and

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development of the common communication system that these emergency response services were to use (C2000) was also set in motion. The objective was, of course, to make it easier to co-ordinate and direct the emergency response of police officers, fire fighters and paramedics [2,3].

At the present moment, 2006, important changes are still on going in the way emergency rooms are operated. The changes are a response to changing conditions in society, the redesign of emergency response organisations, and changed technological possibilities. In addition, changes seem to have arisen from the manner in which the two systems actually fit into the work of the operators in the emergency rooms and the stakeholders they represent. Thus for the two systems – C2000 and GMS –, that were originally thought to be useful in a straightforward manner, the outcomes have been completely different compared to what was originally intended and choices made ten years ago are currently being reconsidered.

If we want to understand why GMS has drifted so far off course, two rival perspectives stand out. In the first perspective, the 'initial infighting perspective', technology is regarded as an instrument for the redesign of social relations, and, subsequently, opportunities for policy choice and social influence are mainly open in the initial phases of a technological development. In the second perspective, information systems emerge as a result of continuous user re-invention and use, employee tinkering, workarounds, and negotiation with IT managers. We explore these perspectives through a case story of the introduction of a new information system (GMS) in a number of comparable organisations (emergency rooms).

The central argument of our story is that too much attention was paid to drawing lessons from the initial infighting perspective, while much of the final outcome might be the result of the co-evolution of system- and user demands. When both perspectives are applicable it is essential to develop policy awareness of the second type of change in addition to the first in order to redress the adverse consequences of system drift.

In the next section, we deal with initial infighting and stabilisation versus emergent change as perspectives on system change. Next we provide a short description of (1) GMS and the way the Dutch Ministry of Internal Affairs has tried to implement it, (2) the emergency rooms where GMS is used, and (3) the way these in turn are operated, and managed. Although the evidence seems to support both perspectives, the social cost of misguided attempts at steering IT deployment make it imperative to decide empirically the precise applicability of each. Using the findings from this case study, we therefore finally try to establish when each intervention perspective could be useful. After all, the two perspectives lead to radically different means of intervention. In the initial infighting perspective the main concern with regard to influencing the information system is one of the inclusion of stakeholders and user groups in the system design. These recommendations have found their way into systems development and design to a greater or lesser extent. It is inappropriate however to assume that stakeholders and users have stable preferences and work routines. Thus, the initial infighting perspective leaves the question unanswered as to whether in the long run information systems remain stable or whether ongoing changes and reinvention determine the way systems work out. Obviously, if the latter is the case, then identifying the sources of change and monitoring the direction of actions in the workplace during the entire life of an information system – which is what 'emergent change' calls for – is just as necessary as the inclusion of stakeholders in its initial phase.

2. Initial infighting and emergent change

The implementation of information systems (IS) has given rise to a rich tradition of analysis of the manner in which organisations adapt to such systems and of how implementation can be successful.

Usually, information system development (ISD) theories are classified by confronting an emergent perspective with a top-down/planned perspective on IS implementation; and/or a linear/waterfall/stage-model perspective on IS. Other often-used classifications of ISD theories are Kling's confrontation of 'web models' with 'discrete-entity models', and Hirschheim & Klein's four paradigms [4,5]. Although these are obviously useful, we could say that a different distinction is made in our categorisation. Kling confronted highly rational, technocratic models with models in which the social ecology of information systems is taken into account. His categorisation is one of highly regulated versus disordered approaches towards ISD [4]. The same distinction – order versus chaos – underlies categorisations of ISD in a top-down/planned and/or linear/waterfall/stage-model perspective on the one hand, and emergent perspectives on the other. The distinction we want to make is not one between order and chaos, but one between the attention given to ISD in the initial phase of the life of an information system, and the attention given during its entire life. Two of Hirschheim and Klein's four paradigms resemble our two perspectives a little. These are 'systems development as sense making', and 'systems development as dialectic materialism [5]. Yet, 'systems development as dialectic materialism', is much more simplistic than what we called 'initial infighting', as it distinguishes between two groups only (those who are in possession of a means of production and those who are not). A similar thing can be said about 'systems development as sense making': it is only about sense making and – unlike 'emergent change' – it disregards power and legitimacy. Our most important objection to this categorisation, though, is that it too fails to pay attention to when interventions should take place during ISD.

In what we call the 'infighting perspective', the design and implementation of information systems are usually highly political activities, and analyses of design and implementation from an initial infighting perspective are plentiful [6,7]. The failure of information systems development is often attributed to a failure to acknowledge the political character of its first phases. There are descriptions of the emergence of many 'shadow systems', e.g., when an organisation-wide enterprise resource planning system was introduced at a university [8]. Adherents to this perspective regard introduction as a unique opportunity for change [9] or as an occasion for restructuring power relations. Barley, for instance, showed how younger, more recently trained, radiologists and their technical assistants gain in network centrality as a result of the introduction of new technology [10]. Other scholars too have described how employees working at the margins of a social network can gain in centrality by early adoption of new technology [11]. Others have postulated that it is those actors who take the initiative to introducing a new information system who gain the most network centrality, and claim that it is being able to obtain such a power position that provides the incentive to 'formative investors' [12]. Black, Carlile and Repenning, though, who re-examined Barley's research to study the transition from introduction to stabilisation, found that it is the initial power position of the actors involved, which is responsible for the different outcomes of the introduction of CT scanning. When doctors and technicians both have the expertise necessary to use CT scanning they learn a lot from each other. When doctors possess more expert knowledge than technicians they dominate, but when technicians have an advantage doctors separate themselves from technicians, which leads to sub-optimal use of technology. As the initial power position of the doctors is too strong, technicians can never dominate them [11,13].

Holmström and Stalder analysed the introduction of a cash card in Sweden, which the intended customers refused to use because 'drift' – the change information systems undergo when used – had been prevented. It is through drift, Holmström and Stalder claimed, that technological and social networks are adjusted to one another. Not allowing drift therefore means excluding actors from a social network [14]. The main point made by adherents to the initial infighting perspective is that the preferences of groups connected to the process can be very divergent and that thereafter choices occur that lead to

closure when a functioning system is in existence. This traditional viewpoint can be discerned in specific recommendations proposing the inclusion of social science in the design of systems [15] or for regarding the inclusion of users in the design and implementation as the key to success.

Yet, according to a different perspective, which we have called 'emergent change', the initial phases of an information system's life need not necessarily be the decisive ones: systems are and remain 'emergent'. Ciborra wrote that drift is caused by the workarounds users constantly make when confronted with a new system, and by the various kinds of use that modern information systems allow in combination with end-users' 'coping' and 'practices'. As the way an organisation actually works can never be fully captured in the blueprints produced by systems developers, managing an information system is a matter of negotiation rather than rational design. The design of an information infrastructure, consequently, is to a large degree determined by 'communities of practice', with the actual realization mainly being a matter of 'tinkering'. Surprisingly perhaps, Ciborra [16] welcomed this lack of control. In his opinion, the unpredictability and the sheer complexity of information systems make it impossible to tell beforehand how technology is going to be used. Therefore we simply have to accept the fact that information systems are open-ended and, to a degree, out of control. It is the 'incremental' way of building information systems that is responsible for their success, as no rationally designed, top-down implemented system can be tailored in advance to cope with all the practices, unintended events, perverse outcomes, changes in demands and in IS fashion that it needs to deal with once it is operational. Besides, 'tinkering' often leads to innovation [17].

The seminal articles of Markus, Robey, Boudreau and Orlikowski mark the start of the research tradition of studies into how emergent change actually happens. Markus and Robey started off by putting forward the chicken-and-egg problem. Is it the implementation of a new technology that leads to changes in the social structure, or is it just the other way round? They stated that the answer to that question lies at the basis of three schools of information systems' research: the technological imperative, the organisational imperative, and the emergent change perspective. Adherents to the technological imperative see technology as an exogenous force, which to a high degree determines the behaviour of individuals in organisations, whereas the relation is just the other way round to adherents to the organisational imperative. Finally those who look at the relation from an emergent change perspective, 'attribute causality to complex indeterminate interactions between technology and human actors in organisations' [18]. Orlikowski and Robey were not reticent about declaring themselves openly for the emergent change perspective [19]. They view ICT as an 'institution', which both determines and is determined by human action. Their approach comes down to an application of Giddens' structuration theory to systems development. Giddens stated that social reality is determined by human action as well as by the properties of institutions. It is human action that calls institutions into being, but institutions also determine such action. Consequently institutions are both product and medium of human action. The process of 'structuration', which thus comes into existence, connects the realm of action to that of institutions in three ways: through signification, domination and legitimisation, by use of 'interpretative schemes', 'resources', and 'norms'.

These three relations exists at all phases in the life of an information system as an institution: from development to use, and can be looked at on all levels of analysis: from that of the organisations involved as a whole down to that of the individual user [19]. The organisation as a whole is the level of systems development and the structuring of systems by designers. The level of the individual user is where the social consequences of ICT, stemming from the interaction between system and user, lead to a constant restructuring of the system by the user. Matching organisation and information systems therefore means a constant process of interpretation, legitimisation, and domination by users and systems developers [19],

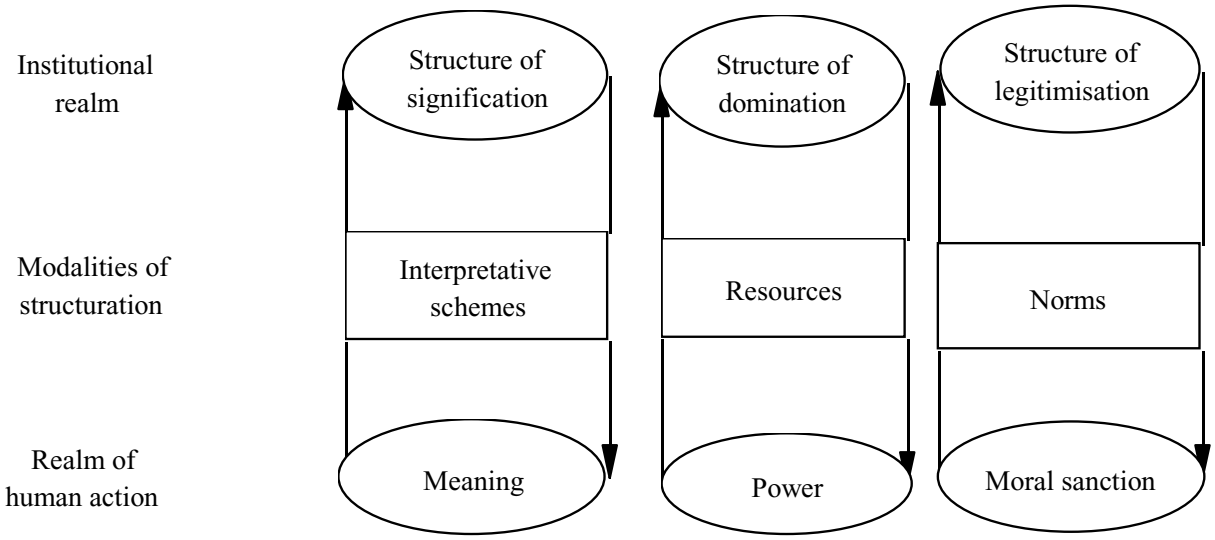

Fig. 1. 'The interaction of Human Action and Institutional Properties as mediated by the three modalities of structuration'. Source: Orlikowski and Robey 1991. Reprinted by permission. Copyright 1991 INFORMS. Orlikowski, Wanda J., Daniel Robey. 1991. Information technology and the structuring of organizations. *Information Systems Research* 2(2) 143–169, the Institute for Operations Research and the Management Sciences, 7240 Parkway Drive, Suite 310, Hanover, Maryland 21076, USA.

as it is not only power that has a role in the way organisations react to new information systems; 'meaning' and 'legitimacy' also play a part [20].

Orlikowski's and Robey's adaptation of Giddens' structuration theory to information systems' research inspired a number of studies in the past few years [7,21–24].

What most of the theories presented above show is that drift is not as chaotic a process as it appears to be from Ciborra's work. It definitely has an underlying structure and requires relatively resistant (or changing) identifiable patterns of interaction between individuals and groups. The question remains how such a structure comes into being. In the initial infighting perspective, the initial phase is the only one that matters, and the games played during it are all about power. In the emergent change perspective, changes come about during the entire life of an information system and legitimacy and meaning also play a role. As said before, what we aim to do in this article is to determine the value of both perspectives in specific circumstances. We do not regard these alternatives to be exclusive, but suggest that they are contingent on organisational and technological factors.

The consequences of the two different approaches to the relation between action and structure of information systems lead to different means of intervention. If one wants to take action on the basis of one of the two perspectives, the differences in the necessary action repertoires turn out to be significant. To be sure about the working of the processes thus means creating more certainty about proper actions. In the case of initial infighting, the main concern with regard to influencing the information system is one of inclusion. The reasoning is that exclusion in the early phases can easily be fatal as, according to some, it is infighting in the initial phase that determines how, and if, an information system is going to be used. The outcome of that fight is supposed to have enormous consequences for the positions of actors involved. Therefore, increasingly a call is made to include user groups and stakeholders in system design. Such attention, however, fails to answer the question of whether in the long run information systems remain stable or whether ongoing changes and reinvention determine the way systems work out . Obviously, if the latter holds true, identifying the sources of change and monitoring the direction of

actions in the workplace during the entire life of an information system are a necessary addition to the inclusion of stakeholders in its initial phase.

Yet, if we want to ascertain when which perspective applies, we need to pay attention to the manner in which the interactions in different sets of social, economic and political actors takes place and how the resulting groups are embedded in a broader institutional context. These relations determine operational practices as well as the work of system developers. Agency is not a matter of individuals, but occurs in groups and networks [25,26]. Pressure from project leaders, 'power users' and peers influences individual users. Such pressure can be direct but more typically, may also occur through the framing of technical issues as solutions to social problems [26]. Transformation in the workplace starts with changes in individual tasks and skills. These then influence relations between individuals. Nee and Ingram [27] wrote that norms arise and are maintained by individual action in a group context. Individuals make choices based on their interests or preferences, which leads to rule and norm outcomes at the group level. Such group level outcomes reinforce or undermine existing formal institutional norms. According to these authors individuals embedded in small groups can either adhere to norms derived from formal norms or object to these. The acceptance of norms in actual behaviour is constrained instead of directed by higher order norms. Norms thus may lose their effect either because they are no longer a centrally reproduced element or as a consequence of active opposition. Changes in role relations consequently influence the social networks, and rearrangement of occupational groups' power bases and may change the organisational and occupational structure of the entire organisation. Finally, when sufficient pressure builds up, a situation with so many anomalies may result in which change at the organisational level even changes the institutions. The opposite process can of course also be discerned. At the level of formal institutions, decisions are made that arise not so much from the wish to align with the working level but from other forces. The ensuing top-down pressure in its turn can stimulate readjustment at the working level. In their elaboration of the links between formal institutional structures and individual action external norms may lead to a reinforcement of internal norms and rules. Yet, at the same time, they stay under pressure from changes and tinkering at the local level [27].

This argumentation, plausible as it is, has hardly been put to the test empirically because it demands an extrication of the interaction processes in domains that have power over other domains from the manner in which the actual work processes are formed and legitimated in these domains. It has been pointed out by Nee and Ingram – but also more broadly in the institutional tradition – that there is still a shortage of studies that really pay attention to the rules and norms as actually adopted versus those designed (in this case in combination with technology) by others. Yet, separating these issues analytically as well as sequentially is necessary to understand whether the mutual influence of technology and work structure is an intermittent or continuous process. Establishing whether we are dealing with an intermittent or a continuous process, in turn, is necessary to ascertain the applicability of the two perspectives on the creation of information systems.

To give an idea of what research into the differences between the two perspectives would mean we provide an empirical illustration below: the introduction of GMS in Dutch emergency rooms. This illustration is based on a study of all relevant policy documents, and on semi-structured interviews with representatives of all GMS stakeholders.

3. GMS and C2000 a long trajectory

At present, the two thousand emergency room operators of the various disciplines work together in a single centre in most police regions, with the important exception of Amsterdam [28]. In order

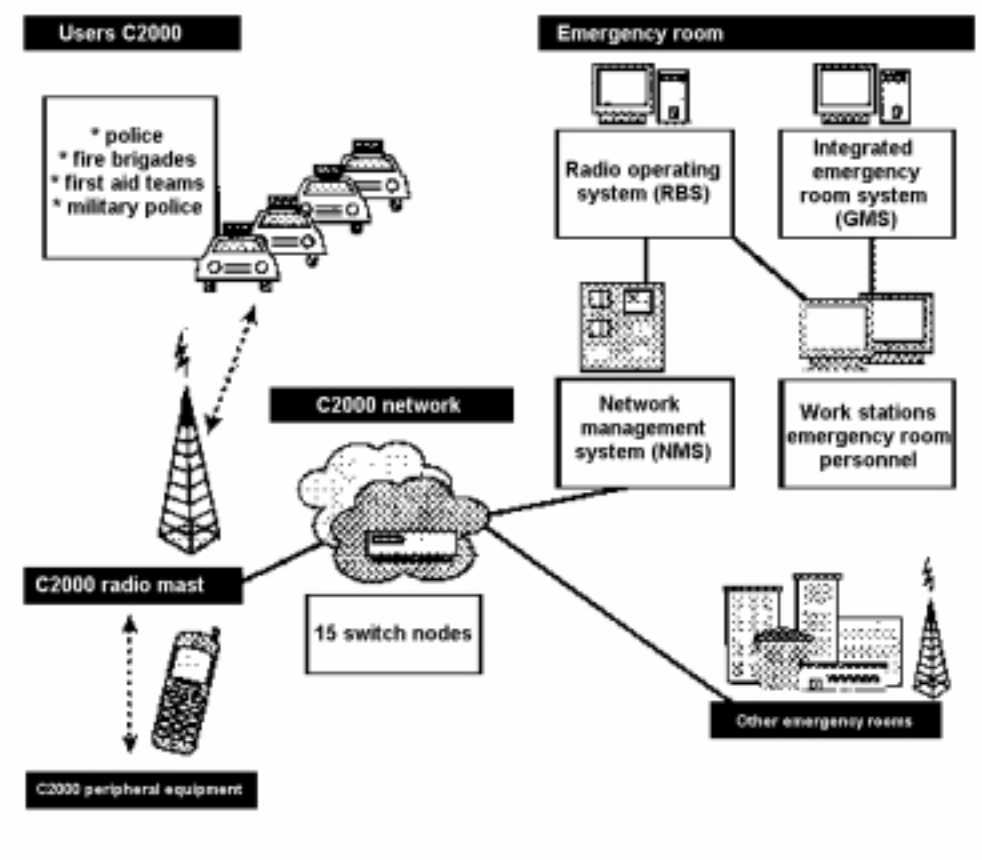

Fig. 2. C2000, GMS and Co-locations. Source: TK, 2002–2003, 28970, nr 2: 9. Reprinted by permission. Copyright Algemene Rekenkamer.

to support the development of joint emergency response the Ministry of Internal Affairs has invested heavily in technological support and unification of software systems. In Fig. 2 the overall system of emergency response is represented as envisioned by the policy makers. The core elements are advanced communication and information devices intended to effortlessly steer emergency response vehicles: C2000, a secure mobile communication system, and the software GMS used to tie various elements together in the back office.

C2000 – the new national communication system for all services providing emergency help, which was intended to replace more than 100 different analogue networks – started in 1993. Three years later the government approved this co-operation between the Ministry of Internal Affairs, the Ministry of Defence, and the Ministry of Public Health. GMS started a year later. In 2002 the separate projects for the realisation of GMS, C2000 and the co-location of the emergency rooms were merged into one project. There is an administrative logic in bundling two related projects as they operate in the same domain. However, according to one of our interviewees, the drive behind the merger was the desire to have the unsuccessful C2000 project profit from the success of GMS and from its favourable reputation. Of course, doing so had consequences for the project organisation. As there are so many stakeholders -police, fire brigades, ambulance services, military police and national police services, several ministries and local government – the project has a complicated organisational structure. To give an impression,

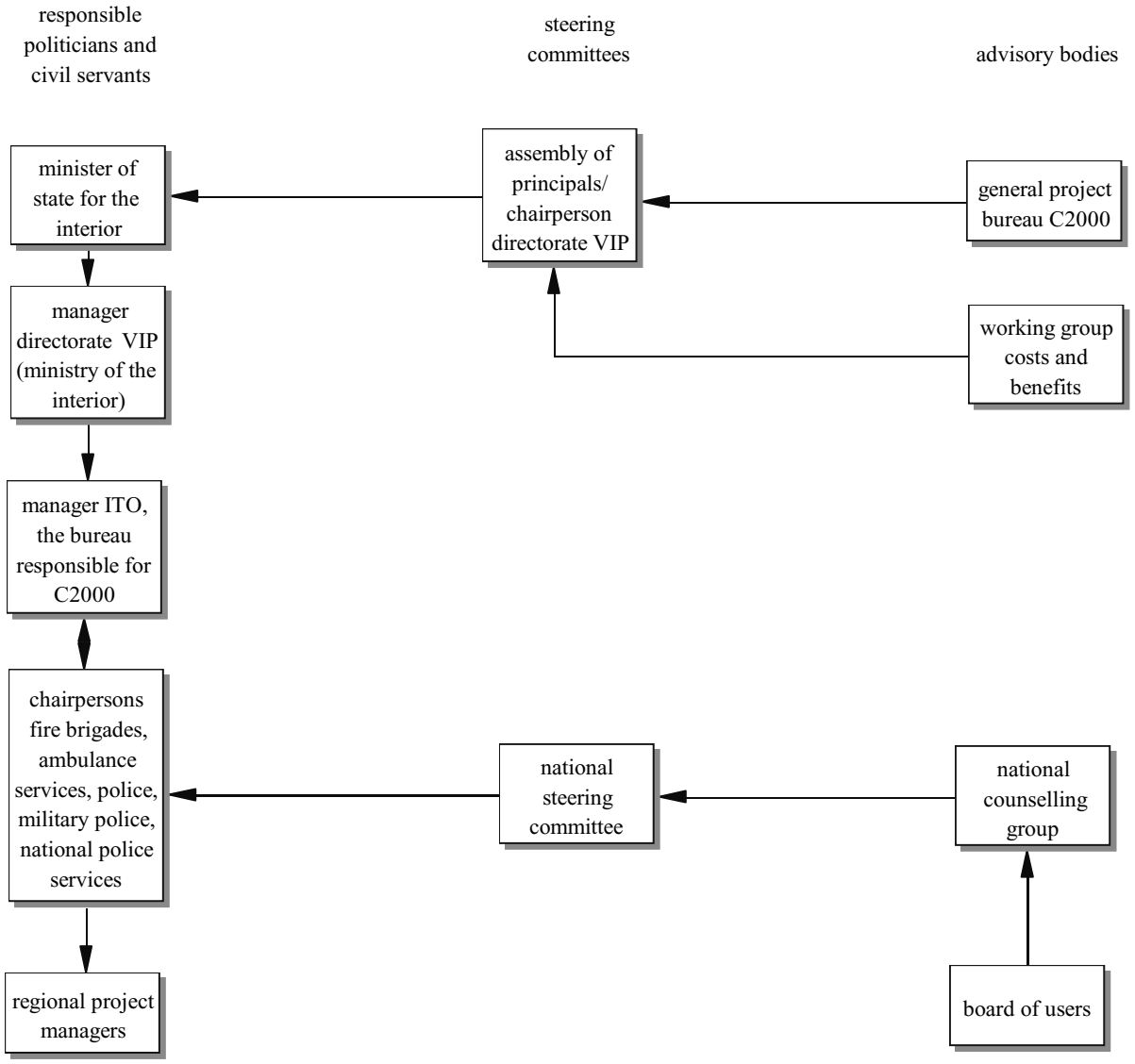

Fig. 3. Actors around C2000. Source: TK, 2002–2003, 28970, nr. 1–2: 12. Reprinted by permission. Copyright Algemene Rekenkamer (Dutch National Audit Office).

the organisation chart below depicts the C2000 project [2].

Of these two projects, C2000 was politically the most sensitive, as it soon became too expensive and technically complex, which is why it was combined with the much more successful GMS project. Yet, combining C2000 and GMS in a single project withdrew GMS from an administratively clear structure and from management attention.

By 2004 GMS was in use in most but not in all emergency rooms [29]. According to the Dutch Secretary of State for Internal Affairs, this project is unique in the world, as such integration has not been achieved anywhere else [30]. And it is only the technical sideshow next to a much more drastic development. The idea is also to standardise the regions that the police, the fire brigades, and the

ambulance services are subdivided into. Ultimately, these are to be merged into 'security regions' under a single regional management [31,32].

Yet, the operation is running far from smoothly. C2000, the joint communication system that the fire brigades, the police and the ambulance services are supposed to use, has been heavily criticised in the daily press. For example, a current affairs programme on television has shown how, during the test phase, the system proved to be so inadequate that police officers needed to resort to their mobile phones to be able to reach the emergency rooms [33]. In most places the emergency rooms of police, ambulance service and fire brigades have been established on the same site, but integration into a single organisation appears to be a bridge too far. And GMS? Emergency rooms adopted GMS on a voluntary basis. This meant that GMS had to support any working procedure found in any emergency room. As a consequence, GMS is a very 'rich' system, which can be tailored to very different needs in every emergency room. Various functionalities have been built in such as geographical information systems to support police dispatching, along with systems to allow scaling up, linking emergency rooms to each other in case of calamities. Combined with coupling to some 50 back office systems, this makes GMS an advanced tool. Yet, exactly because of its complexity, migration of GMS is not easy. The original software core of GMS was acquired in the 1990s, but the implementation was accompanied by regular changes in the software, leading to a release version 4 without reaching implementation in all emergency rooms. In 2005 the situation had become so complicated that discussion abounded about GMS as a system gone out of control. The informants we talked to have different opinions on the system as such, GMS's merits are stressed by a few. In their view, it is the only system that has been introduced (sometimes under pressure from the ministry) in all police regions, that runs in every emergency room on a daily basis. Others have argued that the system is too complicated and when new demands are introduced it becomes unstable. A debate on whether to release version 4.2 or to go to version 5 stalled at the national level. Two critical consultancy reports circulated and were debated in parliament. It is typical of the implementation drive in public administration as well as in the private sector that solutions proposed in these discussions mainly concern design, development and implementation actions. The existence of different voices on the success and staying power of GMS can be linked directly to our theoretical discussion. In our further analysis we chart a number of developments that have produced the current outcomes.

Now, conducting such an analysis in the GMS case introduces a few complexities that make a study of change processes not only interesting but perhaps also unique. The mechanisms behind drift are usually considered to consist of direct relations between actors in a network and their interests in the information technology or its functions. However, it appears that with GMS we have to deal with dynamics on at least three different levels: national (parliament and ministries and representatives of the services), local (the regions), and practice (day-to-day work in the individual emergency rooms). What is more, these levels are (loosely) coupled. Therefore, if we want to find out whether it is emergent change or initial infighting that is responsible for a future GMS drift we need to look more carefully at the manner in which institutional logics emerge, and at which point in time these levels influence each other. In Section 2 we argued that a distinction between the initial infighting and the emergent change perspectives leads to different sorts of intervention. For practical purposes, the study thus not only needs to deal with work and IT practices (and networks) in the emergency rooms, but also to assess the relevant events on the other two levels.

To explain what we mean by that, with regard to the way in which these different networks may be involved in designing and discussing GMS here are two examples: first with regard to the interconnection between the national level and the local level. As can be seen (see also Fig. 3) concerns at the work level are filtered through the hierarchy of players and only certain needs are taken up in system development.

Table 1
Research levels and theoretical approaches

	National system	Regional system	Work system
Initial infighting	Definition of IT needs Delineation of management structure	Management of emergency rooms Relations between system elements	Positioning of occupational identity determines outcomes Implementation of org and ICT renewal occasion for restructuring
Emergent change	Ongoing redefinition external changes determine new options	Interaction on management and national changes change through choices	Day to changes establish routines that interact to IT leading to changes

While this process is acknowledged it is unclear whether the processes systematically filter specific aspects of work problems with GMS. The potential uptake of demands is sketched in two extreme examples. First, in order to adapt the system to local needs, small changes only requiring a limited amount of work by system developers are authorised without explicit decision making. Thus, small changes may accumulate to drift. The second concerns the degree to which the administrative process is played according to the rules. The ministry manages the system ultimately; however in one case cited, the mayor responsible for police work in one of the major cities overruled the chain of command and demanded adaptations directly. It might very well be that the emergence of an officially new power structure at the national level has relatively few connections to the actual work in the emergency rooms.

A second example concerns the attention to the local workforce in the emergency rooms. While the basic process is similar, the variation that occurs might very well be a consequence of the manner in which various professional groups of police officers, fire fighters and paramedics interact, and therefore might be a purely local matter. This is acknowledged in the current vision on developing GMS in the future, for the back-office processes have a differentiation between professions that requires some distance from daily routines of the separate services. However, in other ways emergency operations vary locally as well. The scale of (potential) emergency demands and problems in highly industrialised and densely populated areas requires a scale of operation that is completely different from that in a rural area. Still the demand of the ministry is to provide similar emergency response service everywhere. Lastly, at the local level, integration needs to be maintained with many different back office systems that require integration with GMS to fully exploit its potential, which is why second order input and maintenance is crucial for a fully functional system.

In Table 1 – derived from the GMS case – we have depicted the three different levels on which both theoretical perspectives might operate, as well as the mechanisms possibly involved. Our analysis needs to cover all levels as well as all mechanisms.

If we start such an analysis at the highest level it immediately turns out that at present the development of the GMS software is still very much a project of the Ministry of Internal Affairs. The police organisations responsible for the provision of information systems have not yet taken responsibility for its maintenance. The ministry is also responsible for national co-ordination of implementation, whilst the police, fire brigade and ambulance regions are responsible for regional implementation. The training of the two thousand operators and six thousand end users is being done through a collaborative action by the police, the fire brigade, and the ambulance service training centres. Half of the financing of GMS is a matter for the police regions. The fire brigades and the emergency teams provide the other half [28].

Yet, lately relations between the Ministry and user organisations have deteriorated markedly. As said before, the Ministry of Internal Affairs originally persuaded the emergency rooms to adopt GMS by making it so 'rich' and flexible that it could be tailored to any existing work procedure. Such a system, however, cannot be migrated easily. Recently an inspection by two consultancy firms has even

established that migrating to a higher version of GMS is impossible. The ministry ought to concentrate on the development of an entirely new system. Focussing all efforts on building a new system implies that very little effort can be put in improving the old system. As users feel that the current system is unsatisfactory, they are upset by the news that most of the many shortcomings will not be mended, and that they will just have to wait for a new system. That so many different versions of GMS continue to exist is furthered by the fact that although supply of and demand for IT has been separated on the national level of the GMS project, this separation never really came about in practice, leading to user organisations having too strong a hold on the development of GMS. Another complicating factor is that the emergency rooms are all organised differently.

This brings us to the second level. A fact that adds to the difficulties is that currently the security regions in which the emergency rooms will play such a central role are still in the making. Police and ambulance organisations already share the same regional scale, but the scale on which the fire brigades are organised still differs tremendously. There are also major differences in the way the developing security regions are administered [34]. This does have consequences as in the police force until recently, software choices were made at the level of each of the 26 regions and back office systems are strongly intertwined with GMS. Different back office systems thus introduce differences in software applicability and stability in GMS. The involvement of different institutionally embedded groups is a second reason. The work processes of the disciplines involved differ. Our interviewees compared the police function to that of traffic control, while ambulances are considered transport purely. The three disciplines involved have adopted GMS in different ways: not all regional emergency rooms are housed in the same location, and the various disciplines still have their own management. Thirdly, the disciplines involved bring different resources to bear on the task. Differences are not only a consequence of the work that needs to be done but might also involve different funding mechanisms. There were periods when the Ministry of Health provided funding for the 'wish list' for software improvement of the ambulance services while the Ministry of Internal Affairs was not so forthcoming. Thus the availability of resources for doing the work as well as introducing improvements varies for each of the disciplines. In addition, a direct connection to unrelated processes at the national level exists through the lines of command for each of the disciplines.

When we finally turn to the third level it turns out that, unsurprisingly, problems *within* the emergency rooms can be large as well. In some instances there are difficulties connecting the emergency rooms practice to the working procedures of police, fire brigades and ambulance services. The link between GMS and C2000 sometimes leaves a lot to be desired as well, which has consequences for the support for GMS in the emergency rooms [35]. Yet, the biggest problems are caused by the fact that originally the emergency rooms were able to decide how GMS was to be tailored to their particular needs. This has led to a situation where emergency room operators are constantly pressing for alterations in the information systems they work with. Because of their success in pushing through these demands, GMS has disintegrated into a multitude of local systems, which vary not only per emergency room, but also per discipline. Instead of a single information system in use in 26 regions, systems developers' constant reaction to operators' demands has led to the emergence of approximately 60 different versions of the system. One of our interviewees argued that the emergency rooms differ so much, both in IT and in work processes, that personnel would need weeks to learn to work with the same system if they were to be relocated from one region to another. As systems development is considered to be much 'sexier' than systems maintenance, very little effort has been put in counteracting this fragmentation. At present, as a consequence, the largest part of GMS costs is caused by the difficulties arising from managing all the different versions of the system.

4. Understanding IS' drift in the public sector: some conclusions from the GMS case

Now which perspective best explains what has happened in the case of GMS? And to what policy recommendations does such a perspective lead? If we first apply the initial infighting perspective, we find that it applies to the most central level of the GMS implementation process for the most part. Infighting was a relatively easy phase, since – as happens more often in the Netherlands – the ambition was to pacify all stakeholders by giving them all exactly what they wanted. Implementing GMS, which happened at our lowest level of analysis, was therefore treated as a relatively autonomous process, which was different for every emergency room, and for every discipline involved. The drift caused by tailoring GMS to any particular need was, and is, of course enormous. When did these levels influence each other? When we try to apply Nee & Ingram's work to GMS to study how 'agency' functioned, we find that existing ISD literature paints much too simple a picture of reality to be applicable to complicated public administrative settings like that of GMS. Instead of direct relations between actors in a network and their interests in the information technology or its functions, we find a multilevel structure consisting of a host of different and rapidly changing stakeholders, bringing in new perspectives on GMS and changing its organisational setting over time.

What we can conclude, though, is that in understanding GMS drift, emergent change is a much more useful perspective than initial infighting. The case we studied clearly shows how constant managerial attention during the entire life of GMS would have been necessary to prevent the current outcome, rather than including as many stakeholders as possible in the decision-making during the initial phase. Indeed, it could be argued that it is exactly the application of that perspective, which has brought about the current situation. What, then, should have been done to prevent the current situation from coming into being?

One of the solutions that GMS managers at the most central level are now considering is to buy smaller systems, which are much easier to replace when they become obsolete. There is also talk of minimising the number of links between GMS and other systems, thereby reducing the number of stakeholders as well. A third solution also being currently discussed is standardising work procedures in all emergency rooms first, and then building a new and much more uniform version of GMS. This new GMS would then be controlled from one central point, and there would be much less autonomy granted to system managers and technicians. The first two of these options, obviously, would diminish the problems with which GMS is confronted currently, but would also boil down to giving up on much of the functionality of GMS; probably including precisely that functionality that enables the three disciplines to cooperate via some of the joint emergency rooms at present. Standardising work procedures and then controlling GMS from one central point would come down to forbidding drift, a thing that, in our opinion, is not really possible, and could lead to the emergence of a host of shadow systems. What GMS's management could do is constantly monitor the use users make of GMS, and then decide from one central point what kinds of use they are prepared to accommodate. Yet, that would mean entirely changing the institutional structure in which GMS is embedded. Instead of feedback loops built from a disciplining perspective, it would require constant managerial attention to the friction between system and working processes. Attention that is currently conspicuously absent.

In the development of GMS the emergent perspective on the malleability of technology takes on a different meaning. Along the main lines of the tradition, there is a direct interaction between (undifferentiated) user groups and information technology. The GMS story shows that this process is not continuous and plays in different arenas. If we take one step back, the following pattern emerges. The adoption decision and the design were part of a conscious redesign of both the work organization and the technology used to restructure the social processes of emergency services. In hindsight this decision

had a strong technological determinism to it. The interaction that followed in the implementation phase took to heart the lessons of large-scale implementation and accommodated user wishes. The processes that occurred run parallel to many previous studies such as Boudreau and Robey's observations on system implementation (2005). Thus, when we look directly at system-organization interaction, we see that political choice and adaptive structuration of the technology played a role in different phases of GMS's history. However, in contradiction to the views of the emergent perspective the case reveals that in subsequent phases, the technology failed precisely because of its malleability to user wishes. System management became too entrenched in accommodating changing use. Therefore, an important suggestion that follows from our study is that there not only is a temporality to emergent change, but that with regard to enactment, the actors themselves (both institutionally and with regard to the people representing them) evolve too, independently of the technology. The actions in totally unrelated areas but connected by structuration processes in the institutional domain, which is loosely coupled to the emergency room operations, had an impact on the ongoing interactions at the IT system level. Thus, in the end, optimal system development requires that the lack of coherence between acts in different domains around the technology be dealt with. These observations lend support to a more thorough analysis of who the relevant actors are in the case of large-scale system development. For policy and management purposes it means that evaluation of the changing interactions beyond the direct technology users and management should be part of IS management.

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